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GEOLOGICAL STRUCTURE AND HANGING WALL STABILITY AT NEW QUIRKE MINE IN ELLIOT LAKE - PROGRESS REPORT

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GEOLOGICAL STRUCTURE AND HANGING WALL STABILITY AT NEW QUIRKE MINE IN ELLIOT LAKE - PROGRESS REPORT

by

B. Arjang*

ABSTRACT

At the New Quirke Mine 585 m (1,920 ft.) of crosscut exposures were mapped in regard to the occurrence of geological fracture and weakness planes. Analysis of mean orientation and spacing show the following:

		Orientation Dip Direction/Dip	Spacing m (ft.)
Bedding:		195°/25°	
Joint Set I	(NE-Joints):	335°/70°	2.27 (7.5)
Joint Set II	(NW-Joints):	050°/72°	2.74 (9.1)
Joint Set III	(NS-Joints):	100°/75°	9.16 (30.3)
Shallow Joints sub-parallel):	(Bedding	215°/37°	18.0 (60.6)

Almost all joints analysed at the mine correspond to smooth, planar joints without remarkable aperture, unweathered and free of infilling material. The apparent continuity in different size classes were:

28.26%:	0.6-2 m (2-6 ft.)
55.21%:	2-6 m (6-20 ft.)
7.69%:	6-20 m (20-60 ft.)
8.84%:	> 20 m (> 60 ft.) - faults and dykes

Due to structural features, the rock mass was characterized as solid to massive.

From the observation of ground conditions, the bedding plane slips occurring up to 2 m (6 ft.) above the roof appear to be the most significant

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structural feature followed by shallow thrusts which show smooth slickensides and the unfavourable oriented joint planes.

Joints vary in occurrence and dip angle. A roof failure occurs if a wedge or slab is formed by intersecting joint sets, unless support is provided. Based on structural analysis, a variety of triangular wedges, potentially unstable blocks were predicted. Poor roof conditions appear to be gradually developed over a period of time after mining operations have ceased.

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INTRODUCTION

Most of the ground control research carried out in the Elliot Lake uranium mines has been concerned with the assessment of the stability of the mine roof and mine pillars based on observations of failure in stopes (1, 2) and on the basis of test results obtained from compressive strength testing and in situ stress determinations.

The objective of this study was to broaden the structural geological data base with the objective to identify the variability of the rock mass due to the occurrence of geological fracture and weakness planes. For this purpose detailed mapping of structural features was conducted in five working levels at New Quirke Mine.

About 585 m (1920 ft.) of crosscut exposures were mapped resulting in the measurement of 520 structural planes. The description followed the Discodat Field Guide developed for the Pit Slope Manual (3).

All observed discontinuity planes were analysed on stereoplot diagrams, using the Schmidt-Equal-Area Net, lower hemisphere. For ease of comparison, strike-frequency diagrams were also plotted.

STRUCTURAL GEOLOGICAL SETTING

The New Quirke Mine of Rio Algom Ltd. is located on the northern limb of the Quirke syncline with an east-west axis plunging about 5° to the west, formed in the Archean basement complex. The granite-greenstone basement and sedimentary sequence have been cut by northwest trending faults and intruded by numerous diabase dykes and sills (4,5). The generally massive thick-layered rock sequence strikes nearly east-west (N 105°E) dipping 19°

to 35° to the south-southwest direction. A geological section of Quirke Lake area and ore bearing zone is shown in Fig. 1. Uranium bearing conglomerate reefs are located in the lower Matinenda formation which is unconformably overlaying the Archean basement rock. The conglomerate reefs are separated by quartzite and quartzose sandstone rock units with varying thickness and quartz pebble contents.

The thickness of the ore bearing zone varies from 39 m (130 ft.) to 70 m (230 ft.), whereas to the west of the mining operation area it pinches out. Four ore bearing conglomerates are present including "C", "CL", "B" and "A" reefs which vary in thickness and ore content. "C" reef and partly "A" reef are mined at New Quirke Mine. The hanging wall contact between conglomerate reefs and quartzite beds is usually smooth and well-defined. The maximum depth of mining operations is about 690 m (2300 ft.)

SURVEY OF DISCONTINUITIES

The structural geological survey is aimed at a quantitative characterization of rock masses by sampling a sufficient number of fractures, so that the data can be analysed statistically. The validity of the interpretation of the results depends on several factors which have been discussed in some detail by previous studies (6,7,8,9,10).

In the following, significant parameters which may influence the results of a structural survey and would lead to serious errors, particularly in underground excavations, are briefly summarized.

An approximate record has been kept of the orientation and dimensions of excavations in which the fractures were measured. Thus the observation of joints of any one set is a function of the angle of intersection between that joint set and the orientation of excavation. Also, in an underground

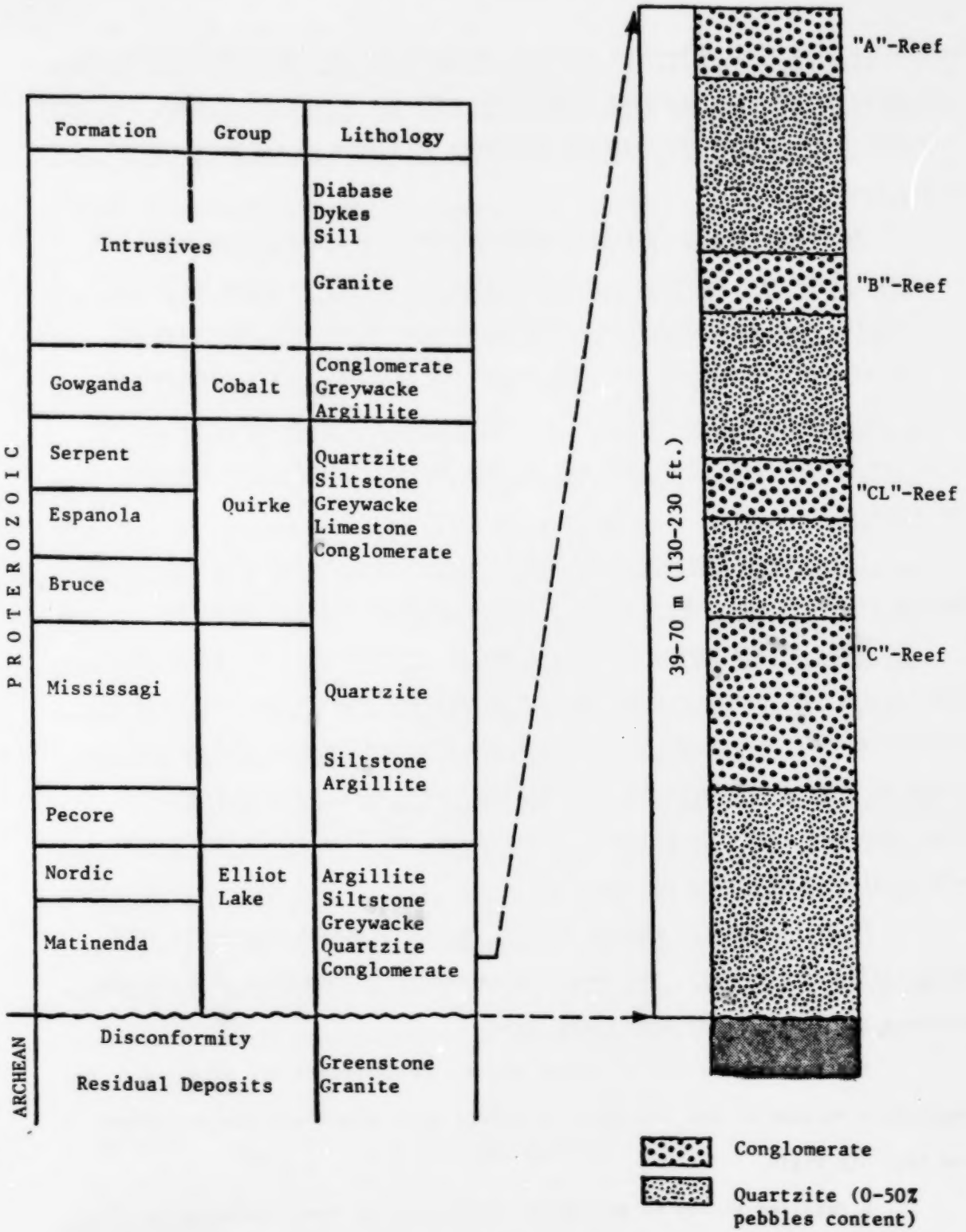


Fig. 1 - Geological section of Quirke Lake area; compiled after Bain (1965) and Robertson et al. (1969) and generalized section of ore bearing zone.

excavation with limited bedrock exposure and particularly uniform orientation, such as crosscuts, the fracture orientation data are likely to provide incomplete information concerning the relative abundance of joints of all sets present in the locality.

To obtain the preferential orientations of multiple joint sets, all existing joints were recorded. Consideration has also been given to joints crossing the rock exposures in a sub-perpendicular direction, which could be counted more frequently, and those which lie parallel to the observation line. Recording the orientation of a disproportional number of those joints which are so oriented that they are usually inaccessible for measurements, was avoided.

Fractures or shallow dipping joints which strike sub-parallel to the bedding plane are more likely to be missed than those steeply oriented.

While mining induced fractures may be confused with naturally occurring joints, the incidence of these is not expected to be high, but there are probably a small percentage of fractures not recorded because they are interpreted as induced fractures due to blasting. Generally, various fractures associated with recent development of sloughing, spalling or feather cracks, were considered as mining induced.

To avoid magnetic compass errors, caused by mining equipment, rock bolts, rails or air ducts, the measurements have been conducted at a certain distance (at least 1.0 m) from these items.

The possible errors in strike and dip measurements are expected to be negligible because of the incidence of joints with relatively limited extent and high dip angle.

A detailed survey of geological structure has been conducted in five working levels at the mine site, crosscuts number 5921, 6931, 7601, 852, 8701, 9721 (Fig. 2). These drifts cut across the rock sequence of the ore

bearing zone. A total length of 585 m (1920 ft.) of excavation has been mapped. All fracture planes of various extents which actually intersect and those which may intersect when projected towards the stretched tape (or footage at waist line) have been measured and recorded in 3 m (10 ft.) intervals. This corresponds to a 3 x 3 x 3 m (10 x 10 x 10 ft.) block. The traverse line sheets (Appendix) represent the direction of observation line and discontinuity data such as orientation, size, infilling, waviness and attitude of displacements.

A total of 520 discontinuities, i.e., joints, faults and dykes have been measured in crosscuts, usually orientated perpendicular to the bedding planes or ore bearing zone. By using the stereographic projection technique the data have been analyzed for each locality. The contoured Equal-Area Net diagrams represent the pole concentrations and frequency of joints and other discontinuities with the relative importance of joint sets indicated by the number of observations. The observation of fracture planes has also been defined by strike-frequency diagrams for each stereoplot diagram.

The term "joint" is applied to any extensive and approximately plane fracture in a rock mass. The joints which have nearly the same orientation constitute a set of joints and the "regional joint system" comprising these joint sets are characteristic of the region. In spite of the fact that a rock mass may be dissected by many joints, it is often possible to recognize three sets. Joints which belong to no recognized sets are referred to as "random joints".

STRUCTURAL FEATURES

BEDDING PLANES

Easterly (N 105°E/25° SE) oriented bedding planes are well defined

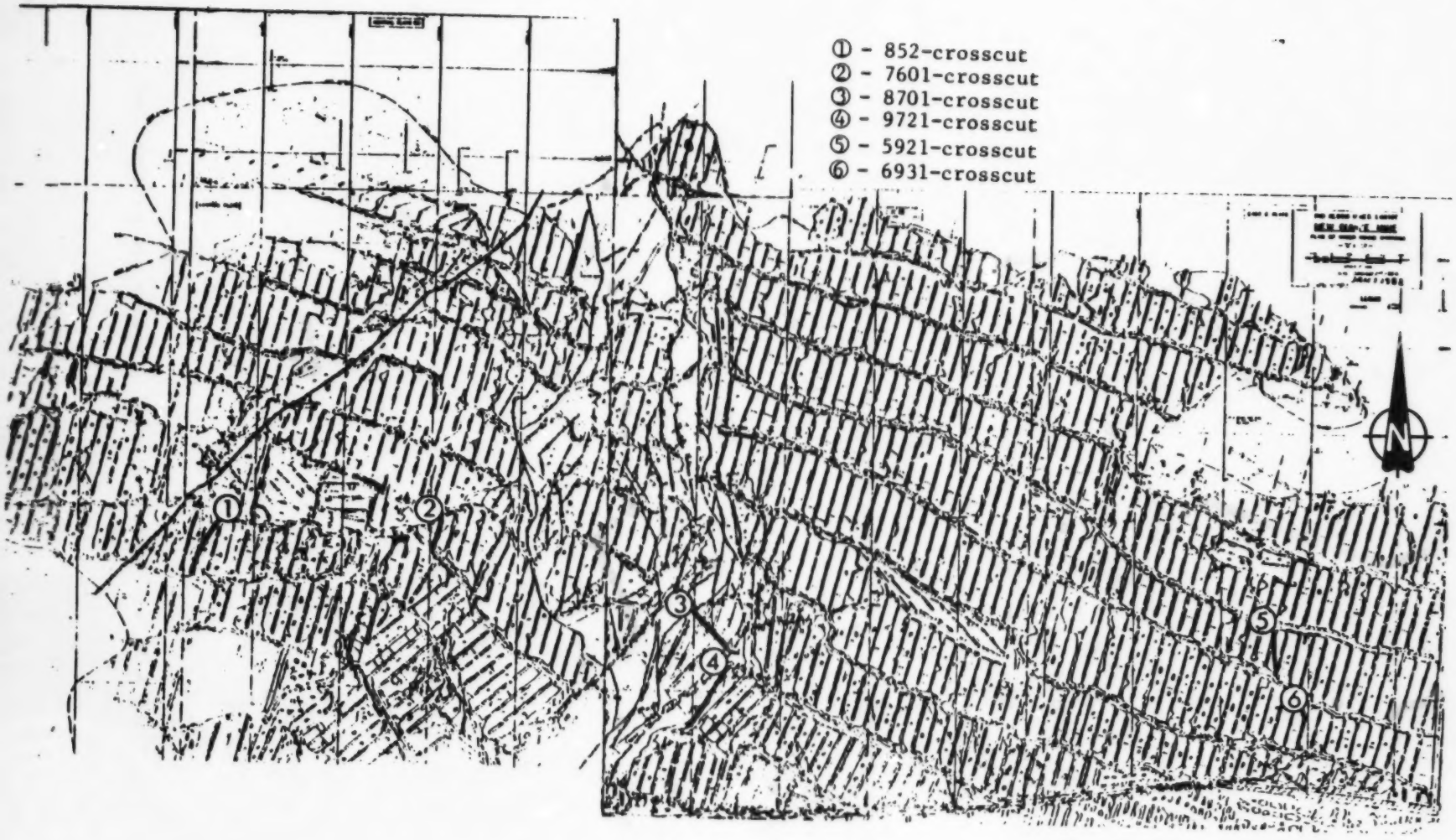


Fig. 2 - New Quirke Mine layout and the location of crosscuts.

on the contact of conglomerate and quartzose rock units. Bedding planes are commonly non-planar and indicate some undulations, particularly in quartzose rock sequences. Evidence of striated (slickensided) bedding planes are observed in some bedded quartzite rocks. Some striated bedding planes are coated with thin quartz which displays distinct steps normal to lineation. The orientation of striations indicate movement predominantly in a northerly direction.

JOINT CHARACTERIZATION

Orientation

The preferred orientations of discontinuities are given in Table 1, which defines the average and the variation in dip direction and dip of dominant joint planes, whereas less significant joints or "random joints" were eliminated. Stereoplot- and strike-frequency diagrams, Fig. 3 to 8, represent the orientation and spatial distribution of fracture planes at various locations.

Generally, the stereoplots in each location indicate two dominant joint sets, northeasterly and northwesterly orientated, whereas the third joint set is not well defined. The variation of north-easterly trending joints in the western section of the mine is much smaller than for the eastern section (5921- and 6931-crosscuts).

An inspection of the results indicates relative consistency of joint orientation in both horizontal and vertical planes in the mine. Due to the consistency in spatial distribution of joint systems over the regional scale of the mine, results from different locations have been replotted on a combined stereoplot diagram (Fig. 9). It is evident that the regional trend is well defined on this diagram and three joint set maxima lying on the periphery of the digram can be identified. The three joint sets were considered as the principal or dominant set.

Table 1 - Dominant joint sets orientation by location.

Location	Joint Set	Dip Direction/Dip	Remarks
5921-crosscut 64300E,6400N	Set I Set II	095-110/60 050/62	Poorly developed NE-joints
6931-crosscut 64500E, 5900N	Set I Set II	090-120/70,280/70,350/60 030/70,065/60	Shallow Joints:215/40 Poorly developed NE-joints Dykes: 014,150/22-72
7601-crosscut 59530E,7000N	Set I Set II	120-150/65,300-320/60 040-060/70	Shallow dipping joints: 205/35
852-crosscut 58300E,6900N	Set I Set II	100-145/75 030/75,210/75	
8701-crosscut 61000E,6400N	Set I Set II Set III	130-150/65 045-60 100/65	Faults: 110-160/90-60 Poorly developed NS-Joints
9721-crosscut	Set I Set II	145-170/75,315-330/65 030-070/70,200-240/75	

Note: Bearing and angle of dip (°)

Result average and ranges are summarized, as follows:

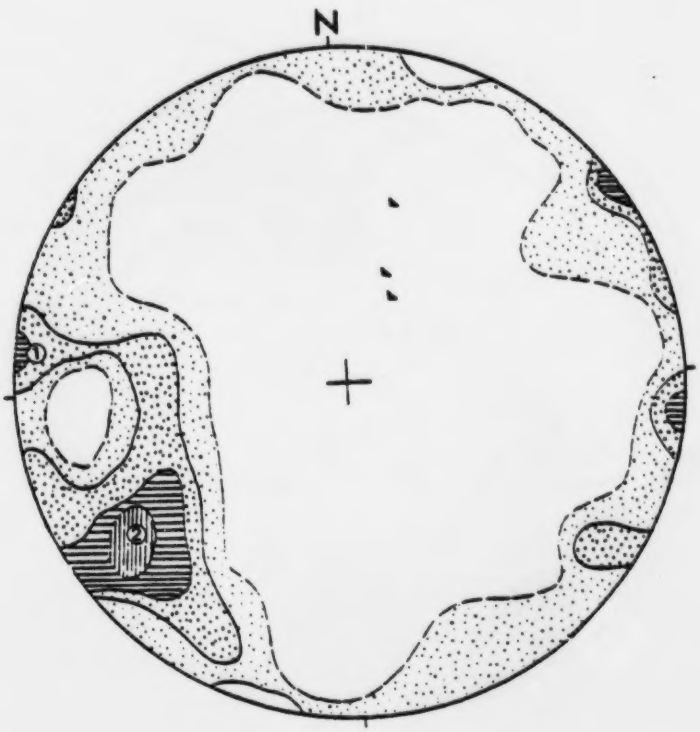
Bedding: $\frac{195/25}{185\text{-}205/19\text{-}35}$

Joint Set I (NE-Joints): $\frac{335/70}{310\text{-}370/90\text{-}60}$

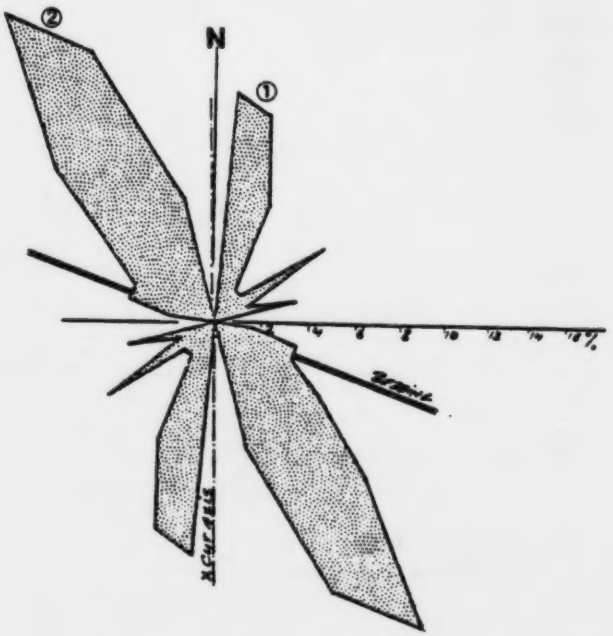
Joint Set II (NW-Joints): $\frac{050/72}{030\text{-}075/90\text{-}45}$

Joint Set III(NS-Joints): $\frac{100/75}{095\text{-}115/90\text{-}50}$

Shallow Joints (Bedding Sub-parallel): $\frac{215/37}{180\text{-}225/28\text{-}45}$



4%
7%
11%
15%
Bedding plane poles

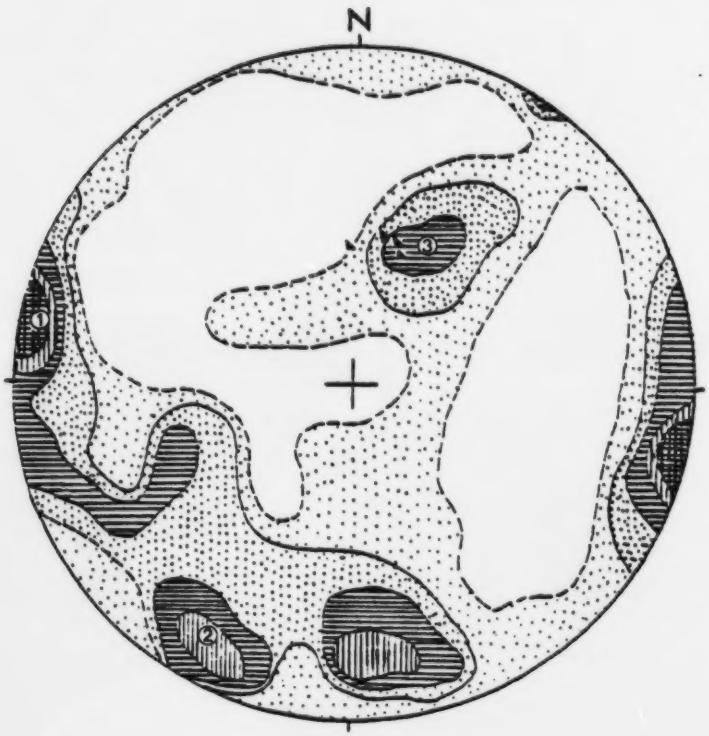


Mean Orientation of Joints:
(dip direction/dip)

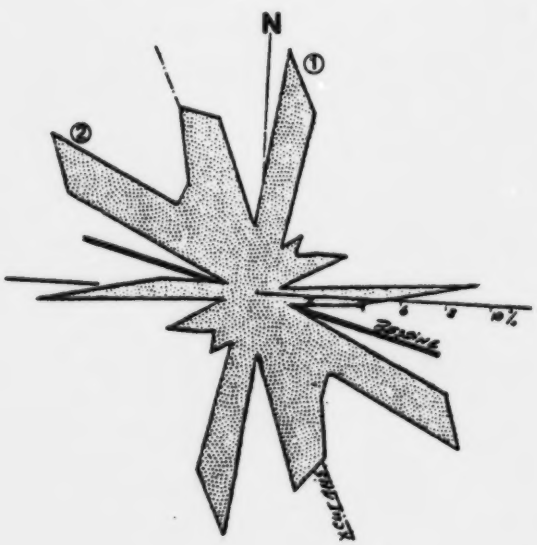
① Joint Set I: 100°/60°

② Joint Set II: 050°/62°

Fig. 3 - Stereoplot diagram 5921-crosscut; frequency contours in percent per 1% area for 53 observations, and strike-frequency diagram.



2%
5%
7%
10%
13%
Bedding plane poles



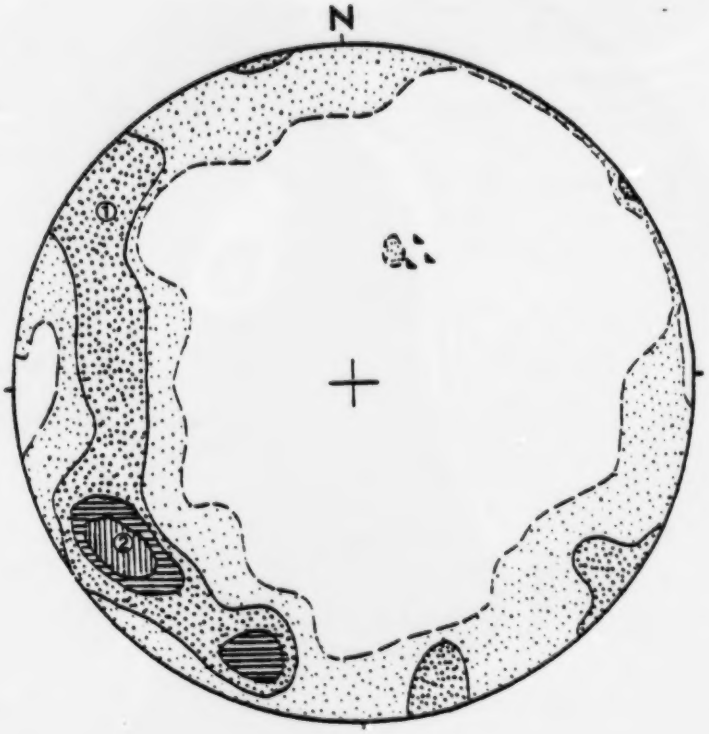
Mean Orientation of Joints:
(dip direction/dip)

① Joint Set I: 105°/70°

② Joint Set II: 030°/70°

③ Shallow Joints: 215°/40°
(bedding sub-parallel)

Fig. 4 - Stereoplot diagram 6931-crosscut; frequency contours in percent per 1% area for 124 observations, and strike-frequency diagram.



3%
6%
10%
13%
Bedding plane poles

Mean Orientation of Joints:
(dip direction/dip)

① Joint Set I: 135°/65°?

② Joint Set II: 050°/70°

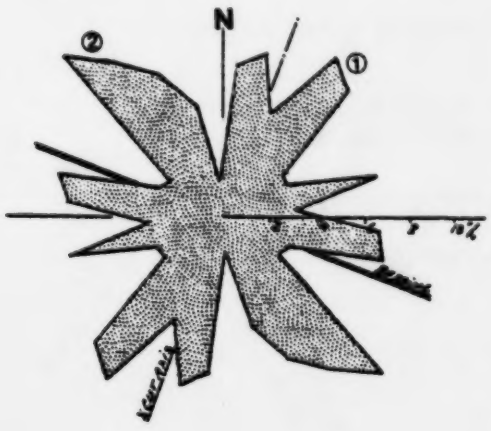
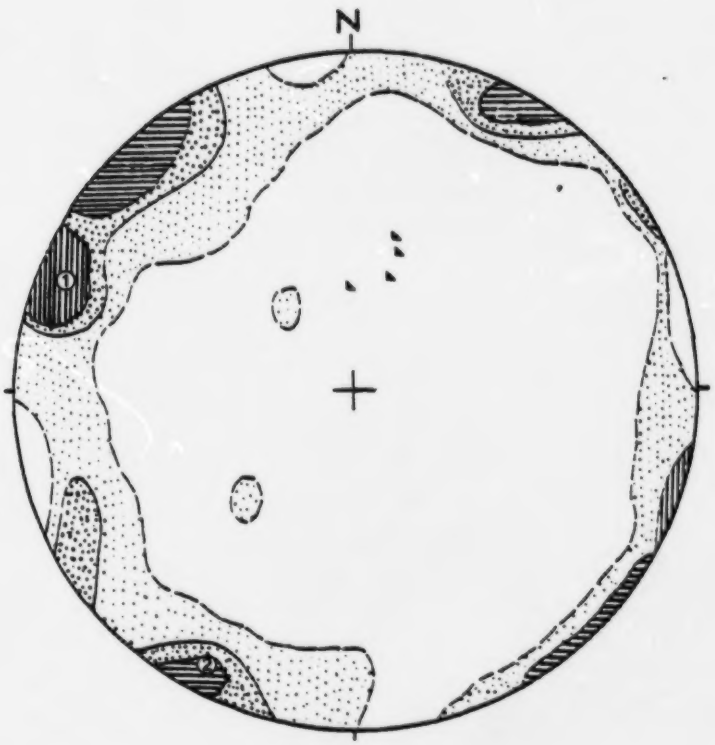


Fig. 5 - Stereoplot diagram 7601-crosscut; Frequency contours in percent per 1% area for 61 observations, and strike-frequency diagram.



4%
9%
12%
14%
Bedding plane poles

Mean Orientation of Joints:
(dip direction/dip)

① Joint Set I: 125°/75°

② Joint Set II: 030°/75°

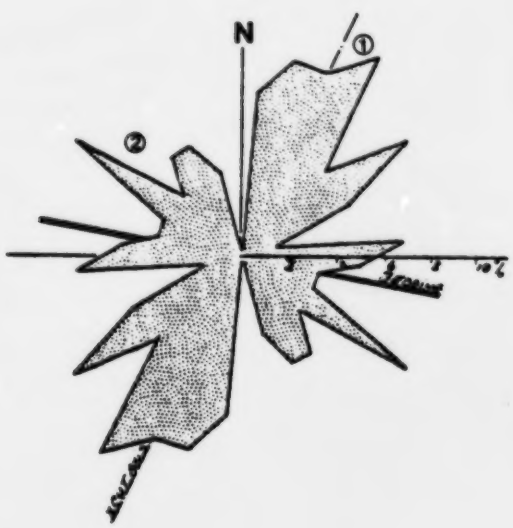
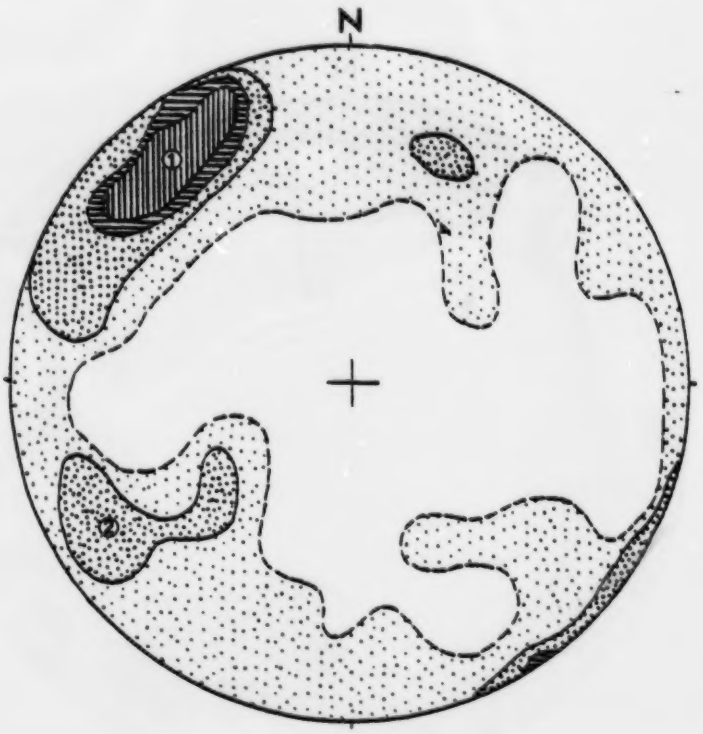


Fig. 6 - Stereoplot diagram 852-crosscut; frequency contours in percent per 1% area for 64 observations, and strike-frequency diagram.



4%
7%
10%
12%
Bedding plane poles

Mean Orientation of Joints:
(dip direction/dip)

① Joint Set I: 140°/65°

② Joint Set II: 045°/60°

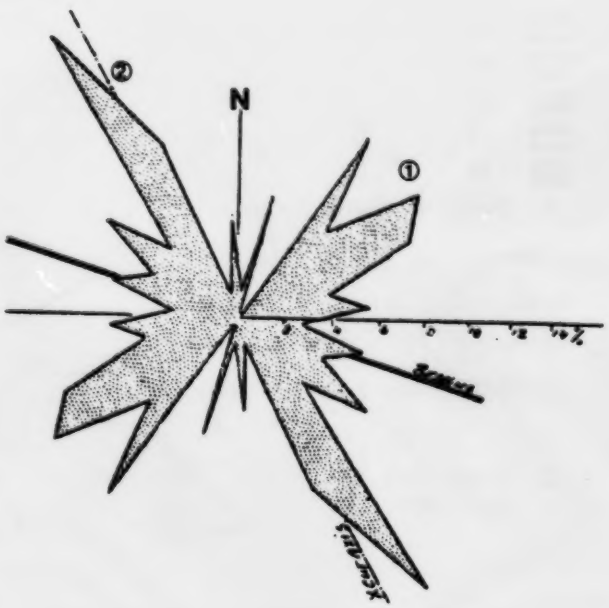


Fig. 7 - Stereoplot diagram 8701-crosscut; frequency contours in percent per 1% area for 72 observations, and strike-frequency diagram.

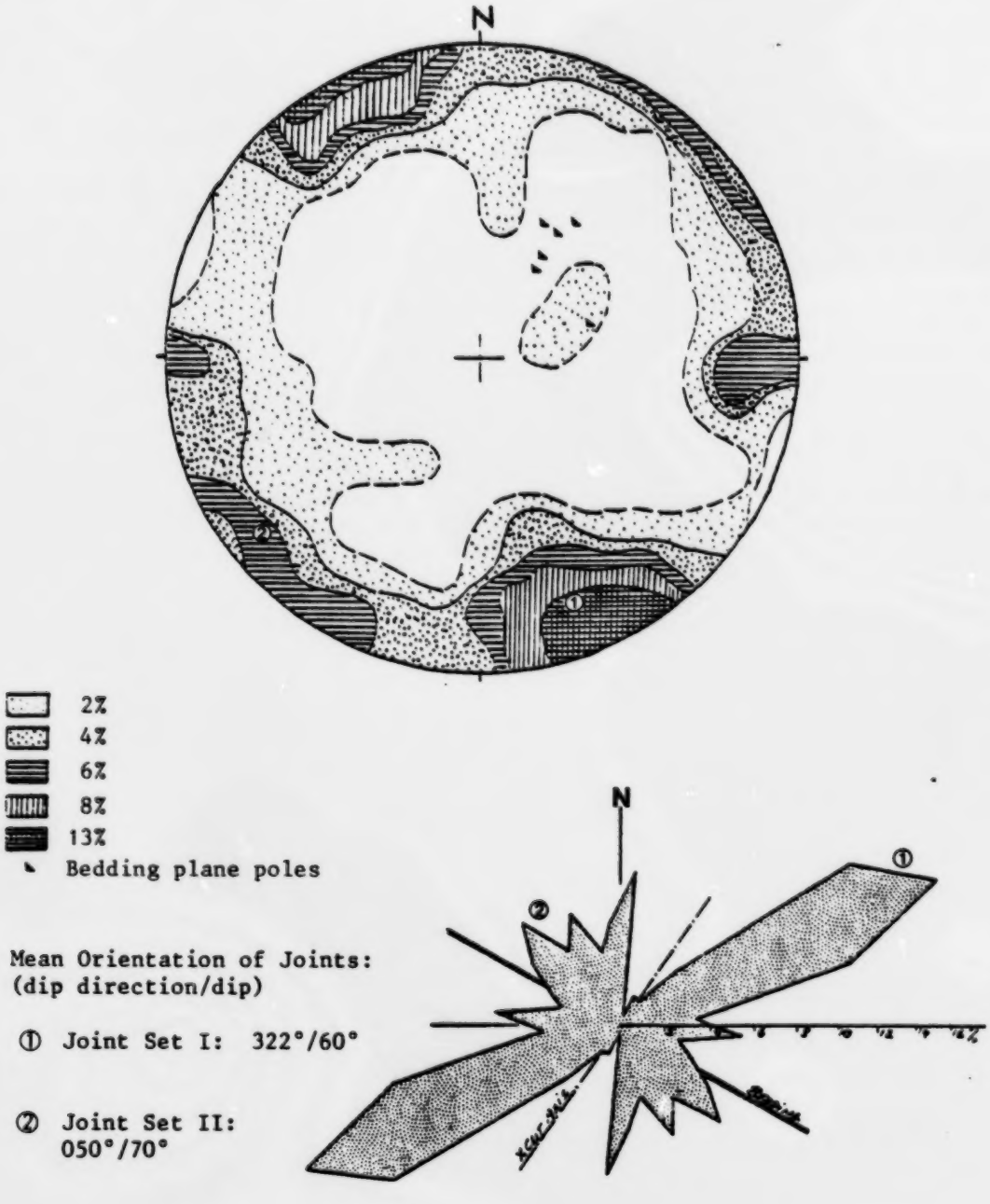
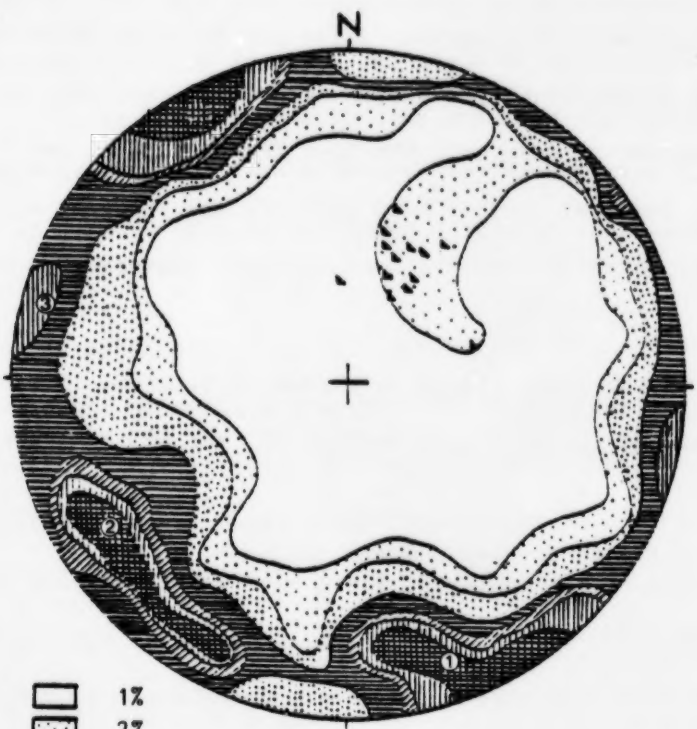
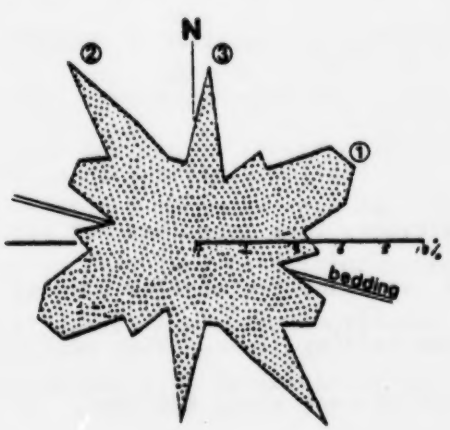


Fig. 8 - Stereoplot diagram 9721-crosscut; frequency contours in percent per 1% area for 145 observations, and strike-frequency diagram.





Mean Orientation of Joints:
(dip direction/dip)

① Joint Set I: 335°/70°

② Joint Set II: 050°/72°

③ Joint Set III: 100°/75°

Fig. 9 - Combined stereoplot diagram; frequency contours in percent per 1% area for 520 observations, and strike-frequency diagram.

The preferred orientation of dominant joint set I is NE/SW (N 30°-65° E) dipping towards NW and/or SE direction; i.e., there are pole density maxima in SE and in NW quadrants of diagram. Joint set II is NW/SE (N 30°-75° W) oriented, dipping predominantly to the NE direction; shown by the pole density maxima in SW quadrant of diagram. The less frequent joint set III strikes NNE/SSW (N 15° E) and dips towards both westerly and easterly direction; therefore, pole densities exist in both the west and east quadrants of the diagram.

The dip angles of the joint planes vary from vertical to 15°, but more than 80% of the measured joints dipped between 90° and 60° as shown below:

Joint Planes Dip Angle Distribution
(by total number of 527)

Dip (Degrees)	Percentage
0 - 10	-
10 - 20	0.7
20 - 30	1.5
30 - 40	3.0
40 - 50	4.1
50 - 60	7.2
60 - 70	12.3
70 - 80	26.7
80 - 90	44.5

Shallow dipping joints, which are likely to scatter in different directions, form less than two percent of the total number of joints. In some locations the shallow dipping joints are found to be nearly parallel to the bedding plane. When well developed, they form horizontal slab-like layers of rock along the roof. An under-representation of shallow joints could be explained as a result of the observation and sampling of fractures only along a horizontal traverse line. Shallow joints may, therefore, be more common than indicated in the diagrams, but due to their orientation they could be locally obscured.

According to principal joint sets, the southwesterly dipping bedding planes (N 105°E/25°W) are cut predominantly by northwesterly or southeasterly and northeasterly dipping joints. The angle of intersection of joint set I and joint set II is nearly perpendicular and they lie obliquely to the bedding plane. The angular relationship between the orientation of major structure is defined in Fig. 10 by means of great circle in the stereographic projection - upper hemisphere.

An extrapolation of joint distribution obtained at New Quirke Mine corresponds to the prevailing fracture system on a regional scale. The joint strike-frequency diagrams (Fig. 11) indicate a reasonable consistency in the preferred orientation of major joint sets at New Quirke Mine, Stanleigh and Nordic Mine and the Elliot Lake region as a whole (11).

Joint set I and joint set II are identified as shear joints which act diagonally to the bedding plane (or Quirke Lake-syncline axis). The shear joints are characterized as planar fractures. They are usually unaffected by local changes in lithology and tend to continue in the quartzose rock unit and also partly cross the conglomerate without changes in their orientation. Occasionally, they occur as conjugated shear joints. Joint set III is developed approximately normal to the bedding plane and can be interpreted as a tension joint system. Such shear- and tension-joints, commonly seen as repetitional, parallel or sub-parallel fractures so that they form joint sets, have been classified as "systematic joints". All other joints are considered as "non-systematic" or "random joints". The latter are usually irregular or curved and characterized by scattering in orientation.

Spacing

The spacing of parallel and repetitional joint planes can be objectively evaluated and is a feature of the prominence of a particular joint set. Spacing

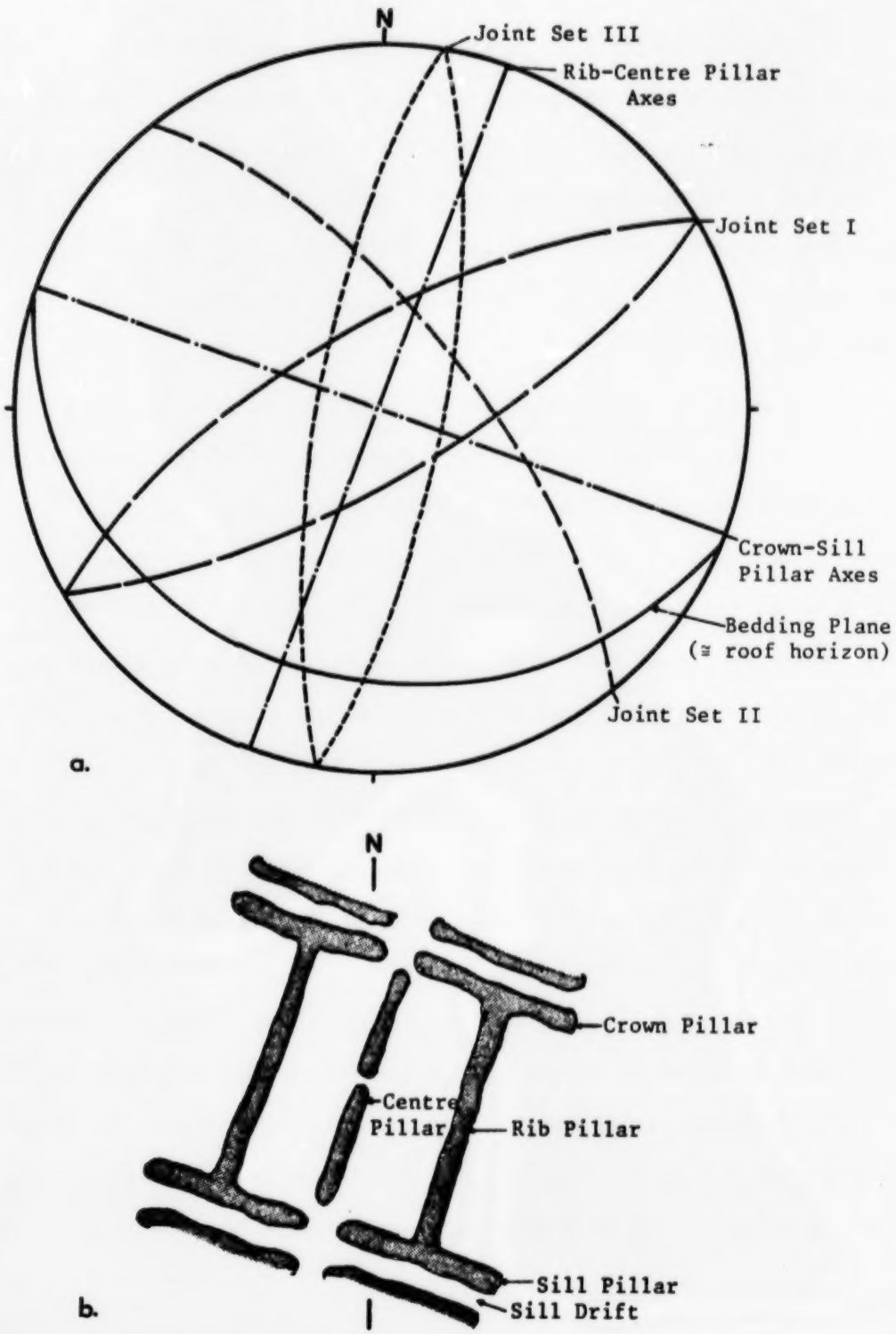


Fig. 10 - a) Angular relationship of major structure and orientation of pillars, b) Stope-and-pillar layout.

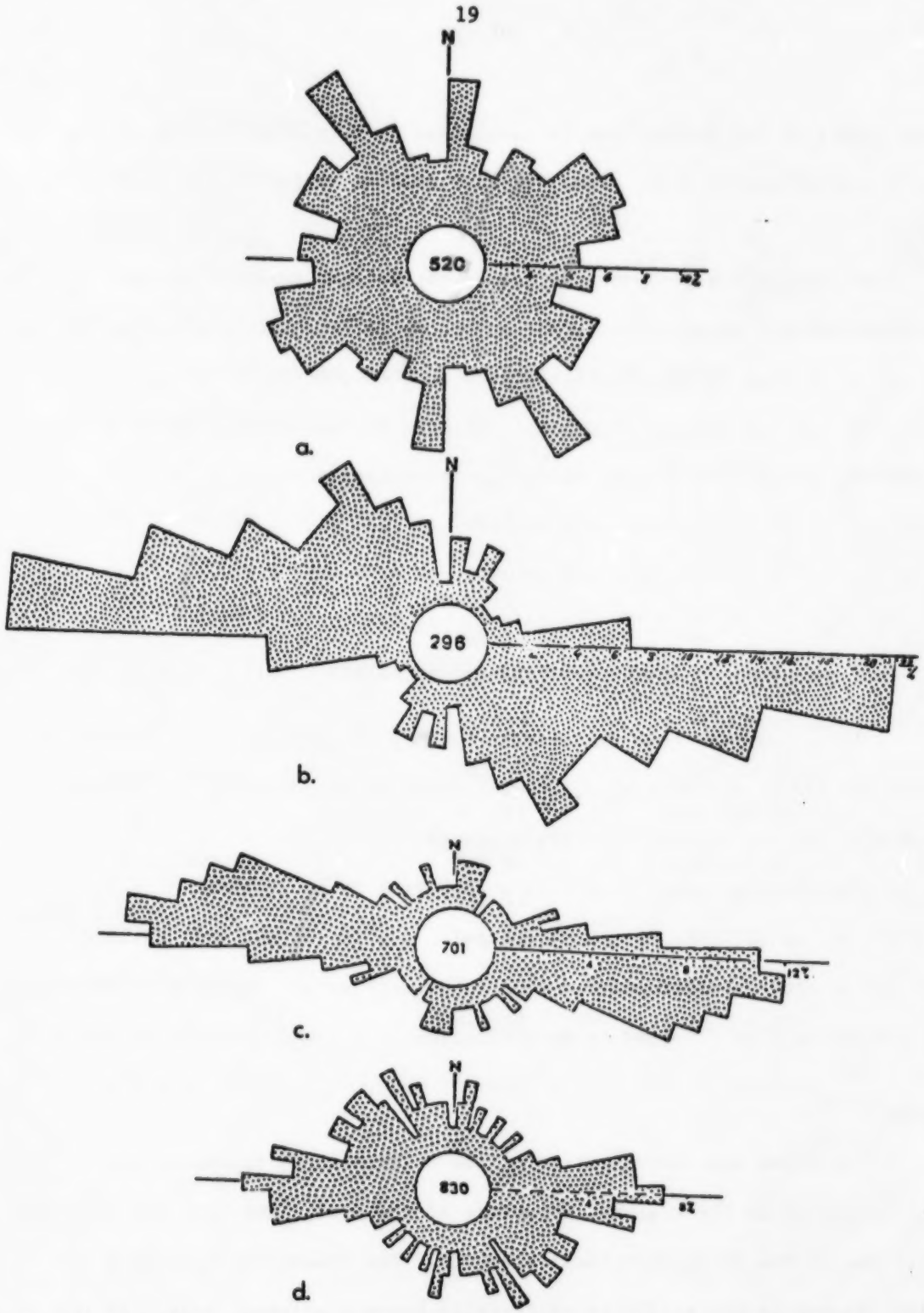


Fig. 11 - Strike frequency diagrams of joints: a) New Quirke Mine, b) Stanleigh Mine, c) Nordic Mine, d) Elliot Lake region (Diagrams "c" and "d" after Bielenstein & Eisbacher (1969); the number of observations is indicated in each diagram).

of the joints at New Quirke Mine is classified as very wide to wide, using Deere's classification (12). Thus the rock mass is characterized as solid to massive.

For evaluation purposes the joints of the same orientation were determined and all joint planes were counted which intersected the observation line and those that would have intersected it when projected.

The average spacing of major joint sets including the shallow dipping (or bedding sub-parallel) joint planes is determined as:

Joint Set I (NE-joints) : 2.27 m (7.5 ft.)

Joint Set II (NW-joints) : 2.74 m (9.1 ft.)

Joint Set III (NS-joints) : 9.16 m (30.3 ft.)

Shallow Joints (Bedding sub-parallel) : ≅18.0 m (60.6 ft.)

It is apparent that predominant spacing of joint set I >joint set II > joint set III at the mine site, whereas easterly trending shallow joints sub-parallel to the bedding are widely spaced.

The spacing ranges from 1.19 m (3.9 ft.) up to 12.63 m (42.1 ft.) for different sets (Table 2). Usually, joint set III is not well defined or could not be clearly distinguished from major sets at all locations. Therefore, this set can only be involved in determination on a regional scale of the mine.

Frequency

The trend and concentration of the deformational fractures are directly related to the regional structure of the area. But they are modified and altered by the local structural elements. The density of fractures can be also related to the stiffness which exist between adjacent beds. At the mine site it can be seen that quartzose rock units are frequently jointed and the joint planes are more continuous than in the conglomerates. The

Table 2 - The spacing of joints by locations

Location	Joint Set	Spacing m(ft)
5921-crosscut	Set I	3.75 (12.5)
	Set II	2.40 (8.0)
6931-crosscut	Set I	1.45 (4.8)
	Set II	1.19 (3.9)
7601-crosscut	Set I	2.21 (7.3)
	Set II	2.21 (7.3)
852-crosscut	Set I	2.30 (7.6)
	Set II	3.80 (12.6)
8701-crosscut	Set I	3.60 (12.0)
	Set II	3.34 (11.1)
	Set III	12.63 (42.1)
9721-crosscut	Set I	1.49 (4.9)
	Set II	1.80 (6.0)

differences in joint frequency are due to lithological fabric, brittleness and also the thickness of rock masses. As a result of different susceptibility to fracturing, the massive conglomerate is considered as relatively incompetent in comparison to the layered quartzose rock sequence.

The joint frequency of different sets can be identified from contoured pole density diagrams in each location. From the combined diagram (Fig. 9) the joint frequency can be determined as joint set I>joint set II>joint set III.

Continuity

Major discontinuities, such as faults and dykes, tend to be extensive in two dimensions (strike and dip), but joints are exposed to a limited extent in the underground excavations. Their absolute dimensions cannot be determined, since the entire surfaces of the joint planes are not exposed. Thus, apparent or visual continuity of traces of joint planes were estimated and recorded (Appendix).

The apparent size or length of discontinuities, obtained by estimating the largest extent in different size classes, and expressed in percentage of total number of measurements, is given below:

28.26%: 0.6-2 m (2-6 ft.)

55.21%: 2-6 m (6-20 ft.)

7.69%: 6-20 m (20-60 ft.)

8.84%: >20 m (>60 ft.) -faults and dykes

Surface

Generally, the observed joints are represented as smooth and planar surfaces. Non-planar joints were also found to be rare on a regional scale (11). Only a few percent exhibited waviness and undulation.

The waviness amplitude of a joint surface ranges between 0°-3° and

rarely exceeds 3°. Usually the main waviness on steeply dipping major joints is found to be lower than on the shallow joints.

The aperture of the joint planes was considered as "tight". Some exceptions were tension joints, wherein seperation or aperture ranges were in millimeters. This characteristic corresponds to most joints regardless of their orientation or continuity.

Roughness on the joint surfaces which was observed in a few locations was slickensided or polished to smooth, and some may fall into the "defined ridges" roughness category.

The joint surfaces were commonly hard, unweathered and free of infilling such as clay, silt or other unconsolidated materials. Some joints contain quartz and quartz-feldspar or a thin quartz coating, wherein the thickness of the quartz filling ranges from a few millimeters to 8 cm. Due to relatively tight joints, these were found to be dry with no evidence of waterflow. In locations where the joints consist of waviness and/or roughness, a ground water penetration along the joint planes appears to be possible. This condition is not expected to be common at the mine site.

In discontinuities such as faults with displacement, or with unconsolidated infilling materials, dampness or staining on the surface was observed. These faults are anticipated to be susceptible to water penetration or even waterflow along the surface.

OBSERVATION OF GROUND CONDITIONS IN REGARD TO GEOLOGICAL STRUCTURE

Rock failure potential at New Quirke Mine varies considerably with location and ranges from minor spalling in the rock surrounding the excavation surface to major rockbursts. Observations at the mine site and the determination of geological structures indicate that the rock failures in the affected

areas are related not only to the existing ground stresses, but to the occurrence of structural weakness planes, such as joints and faults.

In the following, a summary is provided on the interpretation of geological structure, and the main structural parameters which may cause instability at the mine site are discussed.

EFFECT OF BEDDING PLANE SLIPS

At the survey area, the stope layout is oriented parallel to the strike of the bedding. By mining operations the roof line is usually kept at the hanging wall contact and in some cases part of the roof has been mined out to a bedding plane slip. The resultant roof is usually smooth, although uneven surfaces with undulations are common and hanging wall buckling can be observed, particularly where the immediate hanging wall is fissile.

Variations of bedding plane slips exist over extensive areas of the mine and often control the roof condition. The bedding plane slips are also the major cause of ore dilution. Their number and depth vary in different locations and two groups of bedding plane slips, those with 0.60 m (2 ft.) and those more than 0.60 m above the hanging wall contact, have been distinguished.

Thus, structural weakness planes, as a result of the presence of bedding plane slips, exist within one to two meters of the hanging wall quartzite. Most susceptible to movement are the locations where the bedding plane exhibits undulations or when more than one slip plane and/or bedding plane parting exists within one or two meters of the hanging wall contact. Therefore, some relaxation of the rock mass and potentially poor roof conditions can be expected. These poor roof conditions appear to gradually develop over a period of time after mining operations have ceased.

The thickness of hanging wall rock, depending on excavation span, could also affect the roof condition in drifts and stopes, however, the severity

of the effect is not known at this time.

EFFECT OF JOINTING

The jointing of the rock mass and/or complex of joints and other discontinuities, combined with the bedding slips would produce potential weaknesses. Thus, the structurally controlled weakness planes will affect the excavations, in particular the roof condition at the New Quirke Mine.

In particular, poor ground conditions are represented, where the planes of major shear joints (NE- and NW-joints) are developed as a conjugated shear joint system, which intersects the excavation surface.

Where steeply dipping shear or tension joints occur oriented parallel to the sidewall of mining excavations they would initiate excessive vertical load and form thin slabbing or spalling of the rock mass.

Evidence of shallow dipping joints, intersecting the roof horizon would have considerable effect on the hanging wall condition. These discontinuities, (which are probably more frequent than they were observed in the area) may cause hanging wall parting or slabbing and precipitate bedding plane slip. Slabbing and wedge-type failures are common where steeply dipping joints and/or shallow dipping discontinuities intersect a fault plane or a potential zone of weakness in the contact area of hanging wall and conglomerate reef.

Pillar strength can be affected not only by the attitude of bedding planes but also by discontinuities that are nearly parallel and/or oblique to the axis of pillar orientation. The dominant joint sets I and II act obliquely to the long axes of pillars (strike- and dip pillars) and joint set III is sub-parallel with the axes of dip pillars (rib- and centre pillar). Figure 10 illustrates the orientation of principal joint sets and bedding plane (≅ roof horizon), the axes of pillars and also stope-and-pillar layout.

According to the joint pattern, shear movement would occur depending

on the ratio of shear stress to normal stress. Evidence of shearing (e.g. occurrence of slickensides along the fracture surface) around the pillars has been observed in a few locations. This has to be proved on regional scale of the mine, to confirm the shearing action on pillars.

The average spacing of different joint sets in crosscuts (span width ≅ 2.40 m (≅ 8 ft.)) ranges from 1.19 m (3.9 ft.) to 3.80 m (12.6 ft.) for principal joint sets. Extrapolating this average joint spacing to the stopes (span width ≅ 20.0 m (65 ft.)) the joint spacing has to be nearly two times higher than in crosscuts or drifts in order to produce similar effects on the surrounding rock mass.

Figure 12 illustrates some modes of instability by stereographic methods on great circle plots. The determination is based on the graphical method of intersecting three inclined planes (13). From the information displayed on these nets the shape of the wedge produced by structural planes can be established, and also whether this wedge, if left unsupported, will fall, slide or remain stable. The condition for wedge failure is given if the great circles representing the bounding planes of wedges enclose the centre of the net. A sliding may only occur if the three great circles, representing the wedge, form a closed figure which does not enclose the centre of the net and if the potential sliding plane is at a greater angle than the angle of friction of the surface.

By this analysis, nearly all major joint planes, separately or in combination with bedding planes and/or some shallow dipping joints would offer various modes of instability, such as gravity falls of roof wedges, overbreak or sliding failures. The wedge shape and size will be controlled by the orientation of bounding structural planes (joints as well as bedding planes or roof horizon).

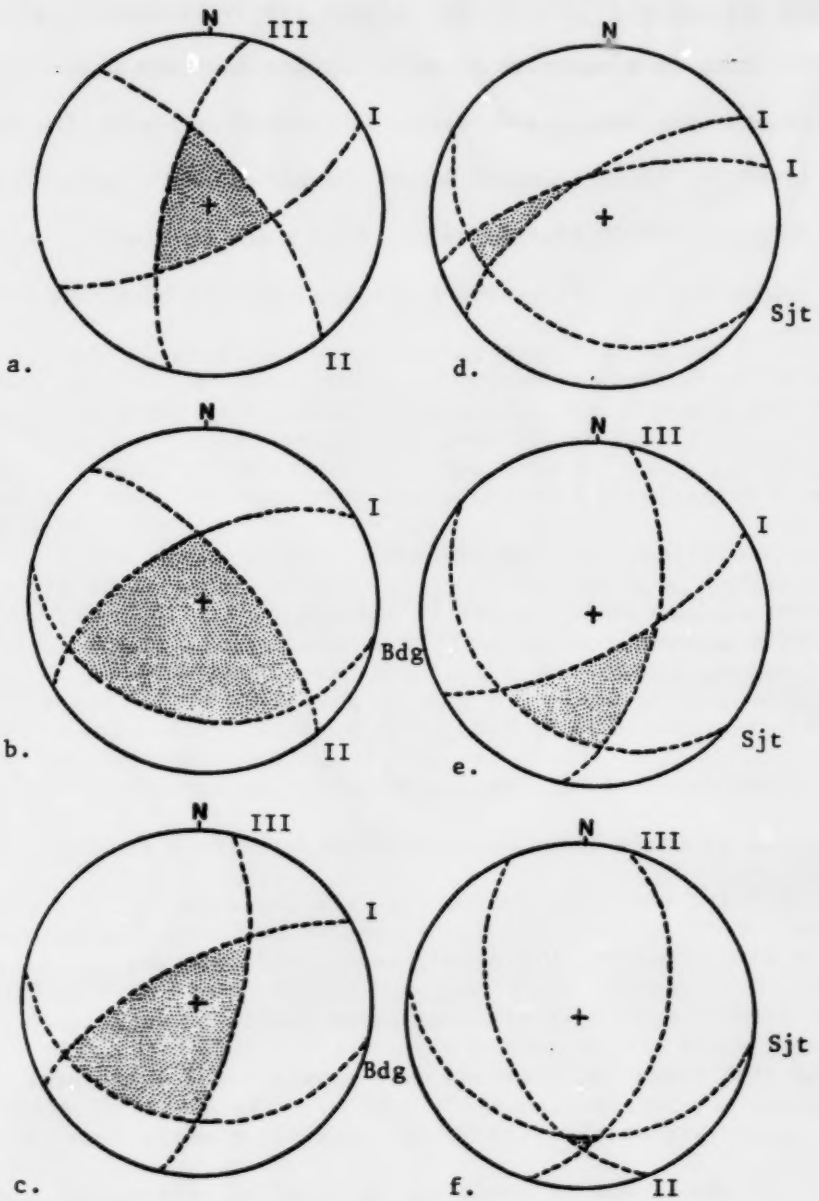


Fig. 12 - Stereographic illustration of some modes of instability; "a" to "c" Gravity falls of roof wedges,"d" to "e" sliding failure of roof wedges, "f" stable wedge condition. Major joint sets (I, II, III); Bedding plane (Bdg); Shallow joint (Sjt).

The stereoplots from different joint planes predict a variety of triangular wedges and potentially unstable blocks likely to fail by gravity fall. Since most fracture planes are steeply dipping (average dip 70°), the presence of large unstable wedges and blocks is not anticipated. The support given to such blocks by the bolting, if installed perpendicular to the plane of fractures, is considered to be adequate.

EFFECT OF FAULTING

The major North-South trending fault zone divides the mine into east and west sections. With some exceptions, the preferred orientation of the fault system is in easterly-southeasterly and northeasterly direction which is in reasonable consistence with the dominant joint orientation.

Some poor ground conditions can be related to faulting such as determined for jointing at the mine site. Additional and more significant effects of faults are considered on parameters such as their extent, displacement attitude or incidence of unconsolidated infilling material. Not only the major faults due to their large continuity and/or displacement attitude would cause instability, but also, frequently, the incidence of some small scale faults with or without visible displacement would produce weakness zones. A correlation of commonly easterly oriented minor faults at some sections of the mine indicate that these could extend over a relatively large area.

Major thrust- and strike-slip faults have not clearly been identified at the mine site. Probably due to their strike parallel orientation and shallow dipping the incidence of these faults could be obscure. But, in some locations, such as in the eastern section of the mine, thrust- or strike-slip faults seem to control domains of different bedding plane slip and may have caused rock failures. At the mine, easterly trending faults and some discontinuities (e.g. dykes) can be related to major thrusts, such as the Quirke Lake Fault.

On a regional scale these fault systems are defined as a combination of bedding plane slip and contraction faulting, which dip generally less than 40°. These were observed in the higher part of the sedimentary rock sequence and are present in the basement rocks in the northeastern part of the Quirke Lake syncline. This interpretation justified the assumption that some easterly trending, although minor, thrust faults existed at the mine site.

The information about both minor faults and thrust- or strike-slip faults, is limited at the mine and their effect is not well known. Because of their importance, particularly in association with other discontinuities, further detailed study is required to determine the presence and extent of these faults in order to determine the magnitude of their influence on rock mass stability.

It is anticipated, that as a result of faulting, stress readjustment would initiate and/or precipitate rock failures in otherwise highly stressed mining excavations. The magnitude of rock failure would depend also on excavation geometry and rate of mining.

ACKNOWLEDGEMENTS

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APPENDIX A - MAPPING SHEETS

KEY

Structural Feature

- BG - Bedding plane
- JN - Joint
- FL - Fault ("NAM" = No appraisal movement)
- ST - Striation
- DK - Dyke

Rock Type (LTHLGY)

- QRZ - Quartzite
- QUF - "FLOATER" quartzite
- CGM - Conglomerate
- CGL - Leader conglomerate
- DBS - Diabase

Filling (VEIN-JOINT-FAULT) = FLNG.

- Q - Quartz
- F - Feldspar
- G - Gouge

Water

- Code 1 - The discontinuity is tight, water flow along it does not appear possible.
- Code 2 - The discontinuity is dry with no evidence of water flow.
- Code 3 - The discontinuity is dry with evidence of water flow, rust staining of discontinuity surface, etc.

Size or Length

The size of discontinuities is recorded in a coded format by estimating the largest extent in any direction and recording the appropriate size class as given below:

- Code A: 0.6-2 m (2-6 ft.)
- Code B: 2-6 m (6-20 ft.)
- Code C: 6-20 m (20-60 ft.)
- Code D: >20 m (>60 ft.)

Hardness (Hrdn.)*

R4 - Specimen requires more than one blow with hammer end of geological pick to fracture - 12000 psi (80 MPa).

R5 - Specimen requires many blows of hammer end of geological pick to fracture it - 3000 psi (200 MPa).

Units

Distances are measured in feet and inches.

Orientation of discontinuity data are measured in dip direction (azimuth).

Dip direction and dip in degree. Angle of declination at New Quirke Mine area is 6½°W.

* Compressive strength is estimated by simple mechanical test with hammer and the description of hardness is mentioned above.

MAPPING SHEET

TRAVERSE LINE

Card Type	Identification	Elevation	Dan.	Formatn.	Pit Bench	
					Level	Location
0,1,0,1	5,9,2,1,-,X,C	, , , ,	,	M A T	, , ,	N,Q,M,

Local Grid		Traverse				Nos.	Reference
Northing	Easting	Trend	Plunge	Length	Sc.	Obs.	Direction
, ,6,4,0,0	,1,4,7,0,0	,0,0	+,0,0	,2,8,1		2,7	, , ,

Remarks: 5921. Crosscut, New Quirke Mine

DISCONTINUITY DATA

,0,2 Card Type											Identification 5,9,2,1,-,X,C			
	Discontinuity				Size	Shape	Flng.		Water	Waves	Line		Lithlgy.	Hrdn.
No.	Distance	Type	Dip/Direct.	Dip			1	2		I L A	Type	Pitch		
0,1	, ,0	B,G	2,0,5	,2,4	.		,		1	1,8,0	,	, ,	Q,R,2	R,4
0,2	, ,1,8	J,N	0,5,2	,7,0	C		,		1	"	,	, ,	"	"
0,3	, ,2,2	"	0,7,0	,4,5	B		,		1	"	,	, ,	"	"
0,4	, ,2,6	"	0,4,5	,7,0	B		,		1	"	,	, ,	"	"
0,5	, ,3,6	"	0,4,6	,7,4	B		,		1	"	,	, ,	"	"
0,6	, ,4,0	"	1,1,0	,7,3	B		,		1	"	,	, ,	C,G,L	"
0,7	, ,4,2	"	0,9,7	,2,4	B		,		2	"	,	, ,	"	"
0,8	, ,4,9	"	0,1,8	,6,5	E		,		1	"	,	, ,	"	"
0,9	, ,5,1	"	0,2,0	,7,0	B		,		1	"	,	, ,	"	"
1,0	, ,6,4	B,G	2,0,0	,2,8			,		1	"	,	, ,	Q,U,F	"
1,1	, ,6,6	J,N	1,2,2	,8,9	A		,		1	"	,	, ,	"	"
1,2	, ,6,8	"	2,5,4	,4,5	D		,		1	"	,	, ,	"	"
1,3	, ,7,1	"	0,9,2	,4,0	E		,W		1	"	,	, ,	"	"
1,4	, ,7,4	"	2,1,2	,8,9	B		,Q		1	(1")	,	, ,	"	"
1,5	, ,7,7	"	0,5,5	,6,2	B		,		1	"	,	, ,	"	"
1,6	, ,8,3	"	2,6,4	,5,2	B		,		2	1,7,8	,	, ,	"	"
1,7	, ,8,9	"	2,0,3	,7,0	A		,		1	1,8,0	,	, ,	"	"
1,8	, ,9,6	"	1,1,5	,5,6	A		,		1	"	,	, ,	"	"
1,9	, ,10,0	"	0,8,0	,4,6	A		,		1	"	,	, ,	"	"
2,0	, ,10,1	"	3,3,2	,6,5	B		,		1	"	,	, ,	"	"
2,1	, ,11,3	"	0,5,2	,8,5	C		,		1	"	,	, ,	"	"
2,2	, ,11,7	"	0,2,8	,7,0	C		,Q		1	1/4"),	,	, ,	"	"
2,3	, ,12,2	"	2,5,6	,7,8	H		,		1	"	,	, ,	"	"
2,4	, ,11,9	"	0,7,2	,5,2	A		,		1	"	,	, ,	"	"
2,5	, ,12,9	"	3,3,0	,2,9	E		,		1	"	,	, ,	"	"
2,6	, ,13,5	"	2,5,8	,6,0	B		,		1	"	,	, ,	"	"
2,7	, ,13,6	"	2,5,8	,7,4	E		,		1	"	,	, ,	"	"

MAPPING SHEET

TRAVERSE LINE

Card Type	Identification	Elevation	Dmn.	Formatn.	Pit Bench	
					Level	Location
0,1,0,1	5,9,2,1,-X,C	, , ,	,	M,A,T.	, , ,	N,O,M,

Local Grid		Traverse				Nos.	Reference
Northing	Easting	Trend	Plunge	Length	Sc.	Obs.	Direction
, ,6,4,0,0	,6,4,3,0,0	,0,0	±,0,0	,2,8,1		56	, , ,

Remarks: 5921 – X CUT, No. 1 Quirke Mine

DISCONTINUITY DATA

•,0,2 Card Type — Identification 5,9,2,1,- X,C

No.	Discontinuity: Distance	Type	Dir. Direction	Dip	Size	Shape	Flag. 1	Flag. 2	Waviness	Waves I	Waves L	Waves A	Line: Type	Line: Pitch	Lthlgy.	Hrdn.
2,8	,1,4,0	J,N	1,1,0	,8,2	B		,			1,8,0			,	, ,	O,4,F	R,4
2,9	,1,4,5	"	0,8,0	,9,0	B		,			"			,	, ,	"	"
30	,1,5,3	"	0,6,8	,8,2	B		,			"			,	, ,	"	"
3,1	,1,5,4	"	0,3,2	,7,0	B		,			"			,	, ,	"	"
3,2	,1,5,6	"	0,3,8	,6,4	B		,			"			,	, ,	"	"
3,3	,1,6,3	"	3,0,2	,7,7	A		,			"			,	, ,	"	"
3,4	,1,7,3	"	3,3,2	,7,5	C		,Q			(½")			,	, ,	"	"
3,5	,1,7,9	"	2,8,5	,8,4	A		,			"			,	, ,	"	"
3,6	,1,8,2	"	0,5,2	,7,5	B		,			"			,	, ,	"	"
3,7	,1,8,7	"	1,4,4	,7,4	B		,			1,7,7			,	, ,	"	"
3,8	,1,9,2	"	0,9,5	,5,5	B		,			1,8,0			,	, ,	"	"
3,9	,1,9,3	"	0,6,5	,5,2	B		,			"			,	, ,	"	"
4,0	,2,0,0	"	0,4,5	,6,2	A		,			"			,	, ,	"	"
4,1	,2,0,5	"	0,5,9	,7,9	B		,			"			,	, ,	"	"
4,2	,2,0,7	"	0,6,2	,2,4	C		,			"			,	, ,	"	"
4,3	,2,1,4	"	1,2,4	,8,2	A		,			"			,	, ,	C,G,M	"
4,4	,2,1,6	"	3,1,5	,8,1	A		,			"			,	, ,	"	"
4,5	,2,2,1	"	1,0,0	,7,7	A		,			"			,	, ,	"	"
4,6	,2,2,9	"	1,1,0	,6,8	A		,			"			,	, ,	"	"
4,7	,2,3,0	"	2,4,5	,7,2	B		,			"			,	, ,	"	"
4,8	,2,3,4	"	3,4,5	,8,0	B		,			"			,	, ,	"	"
4,9	,2,3,5	"	1,8,5	,8,2	A		,			"			,	, ,	"	"
5,0	,2,4,1	"	2,1,5	,8,7	B		,			"			,	, ,	Q,R,Z	"
5,1	,2,4,3	"	2,5,0	,7,3	B		,			"			,	, ,	"	"
52	,2,6,1	"	3,5,0	,8,6	B		,			"			,	, ,	"	"
5,3	,2,7,7	"	3,1,0	,8,5	B		,			"			,	, ,	"	"
5,4	,2,7,8	"	2,3,5	,5,5	C		,			"			,	, ,	"	"
55	281	"	c60	85	B										C G M	
56		BC	195	45											(A, Reef)	

MAPPING SHEET

Card Type	Identification	Elevation	Dan.	Formatn.	Level	Location
0,1,0,1	6,9,3,1,X,C,	, , , ,	,	M,A,T	, , ,	N,Q,M,

Local Grid		Traverse				Nos.	Reference
Northing	Easting	Trend°	Plunge	Length	Sc.	Obs.	Direction
, 5,9,0,0	, 6,4,5,0,0	1,5,5	±,0,0	, 2,8,4		2,6	, , ,

Remarks: 6931-X cut, New Quirke mine

DISCONTINUITY DATA

•,0,2 Card Type												Identification 6,9,3,1, X,C			
No.	Discontinuity				Size	Shape	Fing.		Match	Waves		Line		Lthlgy.	Hrdn.
	Distance	Type	Strike	Dip			1	2		I L A		Type	Pitch		
,	, ,0,0	B,G	1,9,5	,3,5			,		1	, , ,		,	, ,	0,P,Z	R,4
0,1	, ,1,3	J,N	3,1,5	,8,8	C		,		1	1,8,0		,	, ,	,,	2
0,2	, ,1,4	J,N	3,4,2	,4,5	B		,		1	,,		,	, ,	,,	2
0,3	, ,1,5	J,N	3,2,2	,7,8	A		,		1	,,		,	, ,	,,	2
0,4	, ,1,8	J,N	3,1,5	,3,5	B		,		1	,,		,	, ,	,,	2
0,5	, ,2,0	J,N	3,4,2	,8,0	A		,		1	,,		,	, ,	,,	2
0,6	, ,2,1	J,N	1,8,7	,8,2	A		,		1	,,		,	, ,	,,	2
0,7	, ,2,2	J,N	0,1,4	,8,3	B		,		1	,,		,	, ,	,,	2
0,8	, ,2,6	J,N	0,0,0	,7,2	A		,		1	,,		,	, ,	,,	2
0,9	, ,2,8	J,N	0,1,6	,4,5	B		,		1	,,		,	, ,	,,	2
1,0	, ,2,9	J,N	3,5,8	,5,0	C		,		2	1,7,6		,	, ,	,,	2
1,1	, ,3,7	J,N	3,4,0	,6,0	B		,		1	1,8,0		,	, ,	,,	2
1,2	, ,4,0	J,N	0,0,8	,8,0	B		,		1	,,		,	, ,	,,	2
1,3	, ,4,4	J,N	0,0,9	,8,5	B		,		1	,,		,	, ,	C,G,H	2
1,4	, ,4,6	J,N	3,4,2	,4,6	B		,		1	,,		,	, ,	,,	2
1,5	, ,4,9	J,N	0,4,3	,5,0	B		,		1	,,		,	, ,	,,	2
1,6	, ,5,1	J,N	0,3,5	,4,6	A		,		1	,,		,	, ,	,,	2
1,7	, ,5,5	F,L	1,3,0	,7,8	D		,		2	1,7,8		,	, ,	,,	2
1,8	, ,5,8	J,N	0,4,7	,4,5	B		,		1	1,8,0		,	, ,	,,	2
1,9	, ,6,1	J,N	0,7,5	,9,0	A		,		1	,,		,	, ,	,,	2
2,0	, ,6,3	J,N	3,1,6	,4,5	B		,		1	,,		,	, ,	Q,R,Z	2
2,1	, ,6,7	J,N	3,4,2	,8,8	C		,	Q	1	,,		(½")	, ,	,,	2
2,2	, ,6,9	J,N	0,7,8	,6,4	B		,		1	,,		,	, ,	,,	2
2,3	, ,7,1	J,N	3,1,1	,3,8	A		,		1	,,		,	, ,	,,	2
2,4	, ,7,2	J,N	0,3,0	,6,0	B		,		1	,,		,	, ,	,,	2
2,5	, ,7,2	J,N	3,2,4	,7,5	B		,		1	,,		,	, ,	,,	2
2,6	, ,7,6	J,N	0,6,0	,6,8	A		,		1	,,		,	, ,	,,	2

MAPPING SHEET

Card Type	Identification	Elevation	Dsn.	Formatn.	Level	Location
0,1,0,1	6,9,3,1, X C	, , , , ,	,	M,A,T	, , ,	N,C,M,

Local Grid		Traverse				Nos.	Reference
Northing	Easting	Trend	Plunge	Length	Sc.	Obs.	Direction
, 5,9,0,0	, 6,4,5,0,0	3,1,0	+0,0	2,9,4		5,3	, , ,

Remarks: 6931 - X Cut, New Quinta Mine

DISCONTINUITY DATA

0,2 Card Type													Identification 6,9,3,1, X C	
No.	Discontinuity: Distance	Type	~~Strike~~	Dip	Size	Shape	Clng.: 1	Clng.: 2	Waviness	Waves: I	Waves: L	Waves: A	Line: Type	Line: Pitch	Lthlgy.	Hrdn.
2,7	, ,7,7	J,N	9,3,2	,5,5	A		,		1	1,8,0	,	,	,	, ,	Q,R,Z	R,4
2,6	, ,8,2	F	0,2,4	,7,8	A		,		1	〃	,	,	,	, ,	〃	R
2,9	, ,2,6	F	2,5,3	,7,8	B		,		1	〃	,	,	,	, ,	〃	R
3,0	, ,8,7	R	2,1,2	,3,4	A		,		1	〃	,	,	,	, ,	〃	R
3,1	, ,8,7	R	0,8,8	,5,5	B		,		1	〃	,	,	,	, ,	〃	R
3,2	, ,8,9	R	0,2,2	,7,4	A		,		1	〃	,	,	,	, ,	〃	R
3,3	, ,9,0	R	3,3,6	,7,4	A		,		1	〃	,	,	,	, ,	〃	R
3,4	, ,9,2	R	0,6,4	,8,2	C		,		1	〃	,	,	,	, ,	〃	R
3,5	, ,9,4	R	2,0,4	,3,6	B		,		1	〃	,	,	,	, ,	〃	R
3,6	, ,9,7	R	0,3,4	,8,2	B		,		1	〃	,	,	,	, ,	〃	R
3,7	, ,9,4	F,L	0,8,0	,8,9	D	(2')			3	1,7,8	,	,	,	, ,	〃	R
3,8	, 1,0,0	J,N	2,2,5	,3,0	B		,		1	1,8,0	,	,	,	, ,	〃	R
3,9	, 1,0,0	R	0,4,0	,7,6	B		,		1	〃	,	,	,	, ,	〃	R
4,0	, 1,0,0	R	0,3,8	,7,6	B		,		1	〃	,	,	,	, ,	〃	R
4,1	, 1,0,4	R	0,3,2	,2,5	B		,		1	〃	,	,	,	, ,	〃	〃
4,2	, 1,0,5	R	2,7,2	,8,8	B		,		2	〃	,	,	,	, ,	Q,R,F	R
4,3	, 1,0,6	R	0,9,5	,8,6	A		,		1	〃	,	,	,	, ,	Q,R,F	R
4,4	, 1,0,7	R	2,8,0	,8,8	B		,		1	〃	,	,	,	, ,	Q,R,F	R
4,5	, 1,0,8	F,L	3,1,6	,8,7	D	(NAM)			2	〃	,	,	,	, ,	Q,R,F	R
4,6	, 1,1,3	D,K	1,1,7	,3,0	D	(1')			3	1,8,0	,	,	,	, ,	D,B,S	R,3
4,7	, 1,1,7	J,N	2,8,2	,8,8	B		,		1	〃	,	,	,	, ,	Q,R,Z	R,4
4,8	, 1,1,8	R	0,8,0	,9,0	B		,		1	〃	,	,	,	, ,	〃	〃
4,9	, 1,1,9	R	2,7,5	,8,8	A		,		1	〃	,	,	,	, ,	〃	〃
5,0	, 1,2,0	F,L	0,2,8	,7,5	D	(2')			2	〃	,	,	,	, ,	〃	〃
5,1	, 1,2,2	J,N	3,0,0	,7,2	A		,		1	〃	,	,	,	, ,	〃	〃
5,2	, 1,2,4	R	0,0,8	,5,2	A		,		1	〃	,	,	,	, ,	〃	〃
5,3	, 1,2,5	R	2,1,2	,3,6	C		,		1	〃	,	,	,	, ,	〃	〃

MAPPING SHEET

Card Type	Identification	Elevation	Geol.	Formatn.	Level	Location
0,1,0,1	6,9,3,1, X,C	, , , ,	,	V V T	, , ,	N.S.M.

Local Grid		Traverse				Nos.	Reference
Northing	Easting	Trend	Plunge	Length	Sc.	Obs.	Direction
, 5,9,0,0	,6,4,5,0,0	0,1,0	+,0,,0	2,8,4		2,0	, , , ,

Remarks: 6931 - X CUT , New Quirke Mine

DISCONTINUITY DATA

*,0,2 Card Type												Identification 6,9,3,1, X,C	
No.	Discontinuity Distance	Type	Strike	Dip	Size	Shape	Flng. 1	Flng. 2	Waviness	Waves : L A	Line Type	Line Pitch	Lithlgy.	Hrdn.
5,4	,1,2,7	J,N	3,9,2	,7,5	E		,		1	1,8,0	,	, ,	Q,R,Z	R,4
5,5	,1,2,8	F	1,0,0	,2,1	A		,		2	1,7,8	,	, ,	"	"
5,6	,1,2,9	F	0,5,2	,6,0	A		,		1	1,8,0	,	, ,	"	"
5,7	,1,3,2	F	2,8,6	,2,8	A		,		1	"	,	, ,	"	"
5,8	,1,3,3	F	2,0,4	,4,0	B		,		1	"	,	, ,	"	F
5,9	,1,3,5	F	1,3,0	,2,5	C		,		1	"	,	, ,	"	"
6,0	,1,3,6	F	0,0,0	,5,0	C		,		1	"	,	, ,	"	F
6,1	,1,4,1	F,L	0,9,8	,9,0	D		(N.A.M)		2	1,7,7	,	, ,	"	"
6,2	,1,4,6	J,N	3,0,0	,3,8	B		,		1	1,8,0	,	, ,	"	"
6,3	,1,4,7	F	1,0,0	,8,8	B		,		1	"	,	, ,	"	"
6,6	,1,4,8	F	3,5,5	,6,8	B		,		1	"	,	, ,	"	F
6,5	,1,5,0	F	0,2,6	,5,0	B		,		1	"	,	, ,	"	F
6,6	,1,5,0	F	,9,6	,8,8	B		,		1	"	,	, ,	"	F
6,7	,1,5,3	F	3,4,3	,7,0	B		,		1	"	,	, ,	"	F
6,8	,1,5,7	F	0,1,0	,5,0	B		,		1	"	,	, ,	Q,U,F	F
6,9	,1,6,1	F	2,1,6	,7,5	B		,		1	"	,	, ,	"	"
7,0	,1,6,3	F	0,2,2	,8,2	B		,		2	1,1,8	,	, ,	"	"
7,1	,1,6,4	F	2,1,0	,2,2	A		,		1	1,8,0	,	, ,	"	"
7,2	,1,6,8	F	2,8,0	,8,8	C		,		1	"	,	, ,	"	"
7,3	,1,6,9	F	0,6,2	,7,2	B		,		1	"	,	, ,	Q,R,Z	"
7,4	,1,6,9	F	1,4,6	,1,5	A		,		1	"	,	, ,	"	"
7,5	,1,7,2	F	3,3,0	,2,0	B		,		1	"	,	, ,	"	"
7,6	,1,7,3	F	2,4,0	,1,8	A		,		1	"	,	, ,	"	F
7,7	,1,7,4	F	2,1,6	,2,0	B		,		1	"	,	, ,	"	F
7,8	,1,7,6	F	2,9,0	,2,5	C		,		1	1,7,8	,	, ,	"	"
7,9	,1,7,7	F	2,9,2	,5,6	B		,		1	1,8,0	,	, ,	"	F
8,0	,1,8,0	F	1,2,4	,7,6	B		,		1	"	,	, ,	"	"

MAPPING SHEET

Card Type	Identification	Elevation	Dsn.	Formatn.	Level	Location
0,1,0,1	6,9,3,1,X,C	, , , , ,		M,A,T	, , ,	N,Q,M,

Local Grid		Traverse				Nos.	Reference
Northing	Easting	Trend	Plunge	Length	Sc.	Obs.	Direction
, ,5,9,0,0	,6,4,5,0,0	2,1,0	±0,0	,2,8,4		10,7	, , ,

Remarks: 6931 - X CUT, New Quirke Mine

DISCONTINUITY DATA

*,0,2 Card Type												Identification 6,9,3,1,X,C	
No.	Discontinuity: Distance	Type	Strike	Dip	Size	Spac.	Fling: 1	2	Waviness	Waves: ∴ L A	Line: Type	Pitch	Lthlgy.	Hrdn.
8,1	,1,8,3	JN	2,6,2	,2,4	B		,		1	1,8,0	,	, ,	Q,R,Z	R,4
8,2	,1,9,2	"	2,8,2	,8,0	B		,		1	,","	,	, ,	,","	"
8,3	,1,9,5	"	3,2,0	,2,5	B		,		1	,","	,	, ,	, "	"
8,4	,2,0,0	"	1,9,0	,2,8	B		,		1	,","	,	, ,	, "	"
8,5	,2,0,4	"	2,1,2	,5,5	B		,		1	,","	,	, ,	,","	"
8,6	,2,0,7	"	2,2,5	,5,6	B		,		1	,","	,	, ,	,","	"
8,7	,2,0,6	"	3,2,5	,8,6	B		,		1	,","	,	, ,	,","	"
8,8	,2,0,9	"	3,1,2	,8,0	B		,		1	,","	,	, ,	,","	"
8,9	,2,1,0	"	0,8,0	,8,4	A		,		1	,","	,	, ,	,","	"
9,0	,2,1,2	"	1,1,0	,9,0	B		,		1	,","	,	, ,	,","	"
9,1	,2,1,2	"	0,4,0	,6,7	C		,		1	,","	,	, ,	,","	"
9,2	,2,1,6	"	9,2,2	,8,2	A		,		1	,","	,	, ,	,","	"
9,3	,2,1,7	DK	9,1,4	,3,2	D		(3")		2	1,7,2	,	, ,	D,B,S	R,3
9,4	,2,1,2	JN	2,2,2	,6,0	A		,		1	1,8,0	,	, ,	Q,R,Z	R,4
9,5	,2,2,1	"	9,5,5	,5,8	B		,		1	,","	,	, ,	C,G,M	R,4
9,6	,2,2,3	"	0,2,8	,6,7	C		,		1	,","	,	, ,	,","	"
9,7	,2,2,4	"	0,7,8	,7,2	A		,		1	,","	,	, ,	,","	"
9,8	,2,2,8	"	9,6,8	,4,5	A		,		1	,","	,	, ,	,","	"
9,9	,2,2,9	"	0,6,2	,4,6	C		,		1	,"	,	, ,	,","	"
10,0	,2,3,3	FL	9,5,2	,8,0	D		6,6		3	(3' dia),	,	, ,	,","	"
0,1	,2,3,5	FL	0,6,0	,7,2	D		,		2	1,7,7	,	, ,	Q,R,Z	"
0,2	,2,4,3	JN	0,6,4	,3,8	A		,		1	1,8,0	,	, ,	,"	"
0,3	,2,4,5	DK	1,5,2	,2,2	D		(2")		3	,","	,	, ,	D,B,S	R,4
0,4	,2,4,6	JN	3,5,2	,8,2	B		,		1	,","	,	, ,	D,R,Z	R,4
0,5	,2,4,6	"	3,4,3	,4,4	A		,		1	,","	,	, ,	,","	"
0,6	,2,4,7	"	0,6,8	,6,5	B		,		1	,","	,	, ,	, "	"
10,7	,2,4,7	"	0,7,0	,6,6	C		,		1	,","	,	, ,	, "	"

MAPPING SHEET

Card Type	Identification	Elevation	Dan.	Formatn.	Level	Location
0,1,0,1	6,9,3,1,X,C,	, , , ,	,	M,M,T	, , ,	N,Q,11,

Local Grid		Traverse				Nos.	Reference
Northing	Easting	Trend	Plunge	Length	Sc.	Obs.	Direction
, 5,9,0,0	6,4,5,0,0	3,1,0	+0,0	2,8,4		12,4	, , ,

Remarks: 6931-XCUT ; New Quirke Mine

DISCONTINUITY DATA

*,0,2 Card Type												Identification 6,9,3,1,XC			
	Discontinuity				Size	Shape	Flag		Waviness	Waves		Line		Lthlgy.	Hrdn.
No.	Distance	Type	Strike	Dip			1	2		L	A	Type	Pitch		
0,8	2,4,7	D,K	0,6,1	,1,2	D				2	1,7,4		(1")		D,B,S	R,4
0,9	2,4,8	J,N	0,2,0	,7,4	B				1	1,2,0				D,R,Z	R,4
1,0	2,4,8	"	0,9,2	,8,1	B				1	"				"	"
1,1	2,5,3	"	3,5,5	,7,3	B				1	"				"	"
1,2	2,5,4	"	3,5,8	,7,0	B				1	"				"	"
1,3	2,5,4	"	3,5,6	,6,1	B				1	"				"	"
1,4	2,5,5	"	1,0,2	,2,5	A				1	"				"	"
1,5	2,5,5	"	2,2,2	,8,5	C			Q	1	"		(2")		"	"
1,6	2,5,7	"	3,4,5	,8,7	B				1	"				"	"
1,7	2,6,2	"	3,4,2	,2,6	D				2	1,7,5				"	"
1,8	2,6,4	"	3,9,2	,8,0	C			Q	1	1,8,0		(1")		"	"
1,9	2,6,5	"	2,4,2	,7,3	B				1	"				"	"
2,0	2,6,8	"	3,5,2	,6,6	B				2	"				"	"
2,1	2,7,0	D,K	2,3,2	,1,6	D		(2")		2	1,7,7				D,B,S	R,3
2,2	2,7,2	J,N	0,2,0	,8,2	B				1	1,8,0				D,R,Z	R,4
2,3	2,8,0	"	1,0,1	,6,1	B				1	"				C,G,A	"
2,4	2,8,4	"	3,5,2	,6,7	B				1	"				"	"

MAPPING SHEET

TRAVERSE LINE

Card Type	Identification	Elevation	Dan.	Formatn.	Pit Bench Level	Pit Bench Location
0,1,0,1	7,6,0,1,-X,C	, , , ,	,	H,A,T	, , ,	N,O,M,

Local Grid Northing	Local Grid Easting	Traverse Trend	Traverse Plunge	Traverse Length	Sc.	Nos. Obs.	Reference Direction
, ,7,0,0,0	,5,9,5,3,0	,2,0	±0,0	,2,4,0		2,1	, , ,

Remarks: 7601 – X CUT : Near Quirke Mine

DISCONTINUITY DATA

*,0,2 Card Type — Identification 7,6,0,1,-X,C

No.	Discontinuity Distance	Type	Strike	Dip	Size	Spac.	Flag. 1	Flag. 2	Water	Waves I L A	Line Type	Line Pitch	Lthlgy.	Hrdn.
0,1	, ,0,0	J,N	0,6,0	,7,0	C		,		1	1,8,0	,	, , ,	A,R,Z	R,4
0,2	, , ,	″	0,3,5	,8,8	B		,		1	, ″,	,	, , ,	″	″
0,3	, ,2,0	″	1,9,8	,3,4	A		,		1	, ″,	,	, , ,	″	″
0,4	, , ,	″	3,0,8	,7,5	B		,		1	, ″,	,	, , ,	″	″
0,5	, ,3,0	″	3,1,0	,7,7	E		,		1	, ″,	,	, , ,	″	″
0,6	, , ,	″	3,2,0	,8,8	A		,		1	, ″,	,	, , ,	″	″
0,7	, ,4,8	″	3,4,5	,7,8	A		,		1	, ″,	,	, , ,	″	″
0,8	, , ,	″	3,4,2	,8,5	A		,		1	, ″,	,	, , ,	″	″
0,9	, ,5,0	″	1,6,4	,7,0	A		,		1	, , ,	,	, , ,	″	″
1,0	, ,5,2	F,L	1,7,5	,8,5	D		,		2	1,7,8	,	, , ,	″	″
1,1	, , ,	F,L	3,5,4	,7,0	D		,		1	1,7,7	(1' Dis.)	, , ,	″	″
1,2	, , ,	J,N	0,4,4	,6,5	A		,		1	1,8,0	(N/A	N) ,	″	″
1,3	, , ,	″	1,2,5	,6,5	B		,		1	, ″,	,	, , ,	″	″
1,4	, ,6,0	″	0,4,5	,6,8	B		,		1	, ″,	,	, , ,	″	″
1,5	, , ,	″	0,9,0	,5,2	B		,		2	, ″,	,	, , ,	″	″
1,6	, ,7,0	″	0,8,0	,5,4	B		,		1	, ″,	,	, , ,	″	″
1,7	, , ,	″	3,3,0	,6,3	A		,		1	, ″,	,	, , ,	″	″
1,8	, ,8,0	F,L	1,5,5	,6,3	D		,		2	1,7,8	(1' Dis.)	, , ,	″	″
1,9	, , ,	J,N	1,5,0	,7,5	A		,		1	1,8,0	,	, , ,	″	″
2,0	, , ,	″	2,2,5	,5,2	A		,		1	, ″,	,	, , ,	″	″
2,1	, ,9,0	″	9,7,5	,5,5	B		,		1	, ″,	,	, , ,	″	″
2,2	, , ,	″	9,5,0	,5,5	A		,		1	, ″,	,	, , ,	″	″
2,3	, , ,	″	0,1,4	,8,4	A		,		1	1,7,6	,	, , ,	″	″
2,4	,1,0,0	″	0,7,0	,6,0	B		,		1	1,8,0	,	, , ,	″	″
2,5	, , ,	″	1,1,0	,7,7	B		,		1	, ″,	,	, , ,	″	″
2,6	, , ,	″	1,0,5	,8,0	B		,		1	, ″,	,	, , ,	″	″
2,7	, , ,	″	1,2,0	,6,5	C		,		1	, ″,	,	, , ,	″	″

MAPPING SHEET

Card Type	Identification	Elevation	Dmn.	Formatn.	Level	Location
0,1,0,1	7,6,0,1,-,X,C	, , , ,	,	M,A,T.	, , ,	N,Q,M,

Local Grid		Traverse				Nos.	Reference
Northing	Easting	Trend	Plunge	Length	Sc.	Obs.	Direction
, 7,0,0,0	5,9,5,3,	,2,0	±,0,0	2,4,0		5,4	, , ,

Remarks: 7601 - X CUT ; New Quirke Mine

DISCONTINUITY DATA

*,0,2 Card Type												Identification 7,6,0,1,-,X,C			
	Discontinuity				Size	Spc.	Flng.		Water	Waves	Line		Lthlgy.	Hrdn.
No.	Distance	Type	~~Strike~~	Dip			1	2		I L A	Type	Pitch		
2,8	, , , ,	J,N	9,1,0	,8,7	B		,		1	1,8,0	,	, ,	Q,R,Z	R,4
2,9	,1,1,0	Y	0,9,4	,6,5	A		,		1	, " ,	,	, ,	"	"
3,0	, , , ,	,	9,7,0	,7,4	B		,		1	, " ,	,	, ,	"	"
3,1	, , , ,	,	0,7,2	,7,5	B		,		1	, " ,	,	, ,	"	"
3,2	, , , ,	,	1,2,2	,8,0	B		,		1	, " ,	,	, ,	"	"
3,3	,1,2,0	,	0,6,0	,6,7	A		,		1	, " ,	,	, ,	"	"
3,4	, , , ,	,	6,1,4	,5,0	A		,		1	, " ,	,	, ,	"	"
3,5	, , , ,	,	9,6,8	,6,6	B		,		1	, " ,	,	, ,	"	"
3,6	,1,3,0	,	6,1,0	,5,0	B		,		1	, " ,	,	, ,	"	"
3,7	, , , ,	,	9,5,5	,7,5	C		,		2	, " ,	,	, ,	"	"
3,8	,1,4,0	,	9,7,5	,7,6	A		,		1	, " ,	,	, ,	"	"
3,9	, , , ,	,	9,5,8	,7,7	A		,		1	, " ,	,	, ,	"	"
4,0	, , , ,	,	9,5,2	,5,7	A		,		1	, " ,	,	, ,	"	"
4,1	, , , ,	,	1,3,2	,8,4	B		,		2	1,7,8	,	, ,	"	"
4,2	,1,5,0	,	0,4,3	,7,2	A		,		1	1,8,0	,	, ,	"	"
4,3	, , , ,	,	9,5,5	,7,0	A		,		1	, " ,	,	, ,	"	"
4,4	, , , ,	,	0,4,8	,7,6	B		,		1	, " ,	,	, ,	"	"
4,5	, , , ,	,	9,2,0	,7,8	C		,		1	, " ,	,	, ,	"	"
4,6	, , , ,	,	9,1,4	,7,2	A		,		1	, " ,	,	, ,	"	"
4,7	,1,6,0	,	2,9,0	,8,6	B		,		1	, " ,	,	, ,	"	"
4,8	, , , ,	,	3,2,4	,7,2	B		,		1	, " ,	,	, ,	"	"
4,9	1,7,0	,	9,2,4	,7,4	A		,		1	, " ,		, ,	C,G,M	"
5,0	, , , ,	,	2,5,5	,8,0	A		,		1	, " ,	,	, ,	"	"
5,1	, , , ,	,	3,4,4	,8,2	A		,		1	, " ,	,	, ,	"	"
5,2	, , , ,	,	9,2,6	,7,6	A		,		1	, " ,	,	, ,	"	"
5,3	, , , ,	,	9,1,2	,6,6	B		,		1	, " ,	,	, ,	"	"
5,4	,1,8,0	,	1,3,5	,8,2	A		,		0	, " ,	,	, ,	"	"

MAPPING SHEET

Card Type	Identification	Elevation	Dmn.	Formatn.	Level	Location
0,1,0,1	7,6,0,1,-XC	, , , ,	,	M,A,T.	, , ,	N,Q,M,

Local Grid		Traverse				Nos.	Reference
Northing	Easting	Trend	Plunge	Length	Sc.	Obs.	Direction
, 7,0,0,0	5,9,5,3,0	,2,0°	+0,0	2,4,0		6,3	, , ,

Remarks: 7601 – X Cut, New Quirke mine

DISCONTINUITY DATA

*,0,2 Card Type Identification 7,6,0,1,-XC

No.	Discontinuity: Distance	Type	Strike	Dip	Size	Spc.	Fing. 1	Fing. 2	Water	Waves I	Waves L	Waves A	Line: Type	Line: Pitch	Lthlgy.	Hrdn.
5,5	, , ,	J,N	3,2,2	,72	M		,		1	1,8,0			,	, ,	C,G,M	R,4
5,6	,1,5,1	Y	3,1,0	6,2	B		,		1	,,			,	, ,	Q,R,Z	Y
5,7	, , ,	"	1,2,0	8,6	B		,		1	,,			,	, ,	,,	Y
5,8	,1,9,0	"	2,1,4	8,8	B		,		1	,,			,	, ,	,,	Y
5,9	,2,0,0	Y	0,1,8	8,4	A		,		1	,,			,	, ,	,,	Y
6,0	,2,1,0	Y	1,4,0	8,2	B		,		1	,,			,	, ,	,,	Y
,	,2,2,0	Y	—	—			,			, ,			,	, ,	C,G,M	Y
,	, , ,	Y	—	—	A		,			, ,			,	, ,	,,	Y
6,1	,2,3,0	Y	1,8,5	,75	A		,		1	,,			,	, ,	,,	Y
6,2	,2,4,0	Y	2,8,0	8,5	B		,		1	,,			,	, ,	,,	Y
6,3	, , ,	E	1,7,0	6,8	A		,		1	,,			,	, ,	,,	Y
,	, , ,	,	, , ,	, , ,			,			, ,			,	, ,	, ,	,
,	, , ,	,	, , ,	, , ,			,			, ,			,	, ,	, ,	,
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,	, , ,	,	, , ,	, , ,			,			, ,			,	, ,	, ,	,

MAPPING SHEET

Card Type	Identification	Elevation	Dmn.	Formatn.	Level	Location
0,1,0,1	852-XC			M.H.T.		N.Q.M.

Local Grid		Traverse				Nos.	Reference
Northing	Easting	Trend	Plunge	Length	Sc.	Obs.	Direction
1900	5823.00	025	+01	300		25	

Remarks: 852-XCUT. 1 Near Quirke Mine

DISCONTINUITY DATA

*,0,2 Card Type — Identification 852-XC

No.	Discontinuity: Distance	Type	Strike	Dip	Size	Spr.	Fing. 1	Fing. 2	Water	Waves I L A	Line: Type	Line: Pitch	Lthlgy.	Hrdn.
0,1	0	J,N	1,0,3	74	B				1	1,8,0			Q,R,2	R,4
0,2		T	1,1,0	8,6	A				1					T
0,3		T	12,0	7,2	C				1					T
0,4		T	1,2,0	8,2	B				1					T
0,5	2,0	T	1,3,0	5,5	B				1					T
0,6		T	1,1,3	6,5	A				1					T
0,7		T	1,2,0	7,5	A				1					T
0,8		T	1,2,4	8,0	A				1					T
0,9	3,0	T	1,7,5	7,2	B				1					T
1,0		T	1,6,0	6,5	C				1					T
1,1		T	0,9,5	2,9	A				1					T
1,2		T	0,1,0	8,5	B				1					T
1,3		T	0,2,0	8,6	B				1	1,7,8				T
1,4	4,0	T	0,1,0	8,5	A				1	1,8,0			C,G,L	T
1,5		T	1,3,7	8,4	A				1					T
1,6		T	0,0,8	6,8	A				1					T
1,7		T	0,4,5	3,8	B				1					T
1,8	5,0	T	1,2,5	2,7	B				1					T
1,9		T	1,0,6	8,5	C		Q		1	(2")			Q,R,2	T
	6,0	T												T
	7,0	T												T
2,0	7,1	T	0,2,0	8,7	A									T
2,1	8,0	T	1,1,2	8,4	B									T
2,2	9,0	T	0,9,0	2,6	B									T
2,3	10,0	T	0,7,5	8,2	B									T
2,4		T	1,4,2	8,2	A									T
2,5	11,0	B,G	1,7,5	2,5										T

MAPPING SHEET

Card Type	Identification	Elevation	Dmn.	Formatn.	Level	Location
0,1,0,1	852-XC			HAT		NOM

Local Grid		Traverse				Nos.	Reference
Northing	Easting	Trend	Plunge	Length	Sc.	Obs.	Direction
6800	5830	025	+0	30		49	

Remarks: 852-X CUT ; New Quirke Mine

DISCONTINUITY DATA

*02 Card Type											Identification 852-XC			
	Discontinuity					Spac.	Flng.		Water	Waves	Line		Lthlgy.	Hrdn.
No.	Distance	Type	~~Strike~~	Dip	Size		1	2		I L A	Type	Pitch		
26		JN	143	82	A				1	180			QRZ	R4
27	120	T	140	82	B				1	~			~	T
28		T	150	26	C				1	~			~	T
	130	T							1				~	T
		T							1				~	T
29	140	T	160	75	C			Q	1	(3")			~	T
30		T	110	86	B				1	130			~	T
31		T	055	88	B				1	~			~	T
32		T	115	80	B				1	~			~	T
33	150	T	045	80	A				1	~			~	T
34		T	155	60	B				1	~			~	T
35		T	073	72	A				1	~			~	T
36	160	T	068	63	B				2	178			~	T
37		T	058	60	B				1	180			~	T
38		T	080	74	A				1	~			~	T
39		T	140	85	B				2	~			~	T
40	170	T	210	84	B				1	~			~	T
41		T	147	83	A				1	~			~	T
42	180	T	035	84	A				1	~			~	T
43	190	T	210	85	B				1	~			~	T
44		T	120	85	C				2	~			~	T
	200	T											~	T
45	210	T	090	63	B				1	~			~	T
46		T	260	86	A				1	~			~	T
47		T	062	87	A				1	~			~	T
48		T	015	86	B				1	~			~	T
49	220	T	204	83	A				1	~			~	T

MAPPING SHEET

Card Type	Identification	Elevation	Dmn.	Formatn.	Level	Location
0,1,0,1	852XC			MAT.		NQM

Local Grid		Traverse				Nos.	Reference
Northing	Easting	Trend	Plunge	Length	Sc.	Obs.	Direction
6700	5820	025	-10	30		64	

Remarks: 852 - X CUT, New Quirke Mine

DISCONTINUITY DATA

*,0,2 Card Type												Identification 852-XC			
	Discontinuity				Size	Spc.	Flng.		Water	Waves	Line		Lthlgy.	Hrdn.
No.	Distance	Type	~~Strike~~	Dip			1	2		I L A	Type	Pitch		
5,0	230	JN	125	86	B				1	180			QRZ	R4
5,1		Y	107	83	K				1	"			"	Y
5,2		Y	144	57	A				1	"			"	Y
5,3		Y	155	70	G				1	"			"	Y
5,4	240	Y	213	84	E				1	"			CGM	R4
5,5		Y	110	90	H				1	"			"	Y
	250	Y	T	⌐									"	Y
5,6	260	Y	110	86	A				1	"			"	Y
5,7		Y	035	75	A				1	"			"	Y
	270		⊢	T									QRZ	Y
5,8	280	Y	130	85	B				2	"			"	Y
5,9		Y	142	26	B				1	"			"	Y
6,0	290	Y	032	87	A				1	"			CGM	Y
6,1		Y	010	27	E				1	"			"	Y
6,2		Y	164	72	A				1	"			"	Y
6,3	300	Y	052	80	A				1	"			"	Y
6,4		BG	194	36					2					

MAPPING SHEET

Card Type	Identification	Elevation	Stn.	Formatn.	Level	Location
0,1,0,1	87 0,1, XC			MAT		N,O,M,

Local Grid		Traverse				Nos.	Reference
Northing	Easting	Trend	Plunge	Length	Sc.	Obs.	Direction
6,4,0,0	6,1,0,0,0	1,5,0	±0,0	4,5,6		2,1	

Remarks: 8701-X CUT ; New Quirke Mine

DISCONTINUITY DATA

0,2 Card Type											Identification 8,7,0,1, XC			
	Discontinuity				Size	Shape	Plng.		Water	Waves	Line		Lthlgy.	Hrdn.
No.	Distance	Type	Strike	Dip			:	:		: L A	Type	Pitch		
0,1	,,,6	JN	1,2,5	,8,9	B		.		1	1,8,0			C,G,M	R,4
0,2	,,1,2	JN	0,5,6	,3,0	"		.		1	"			"	"
0,3	,,1,3	JN	0,5,6	,7,0	C		.		1	"			"	"
0,4	,,1,4	JN	3,5,8	,3,3	C		.		1	"			"	"
0,5	,,1,4	JN	0,5,7	,3,5	C		.		1	"			"	"
0,6	,,1,6	JN	0,0,0	,7,0	C		.	Q	1	"	(1")		"	"
0,7	,,1,7	JN	0,8,5	,8,5	B		.		1	"			"	"
0,8	,,1,9	JN	0,5,4	,4,0	B		.		1	"			"	"
,9	,,2,3	FL	1,2,5	,8,7	D		.		2	1,7,3	(1'	D(S.)	Q,R,2	4
1,0	,,2,6	JN	1,6,2	,8,5	C		.		1	1,8,0	(1,5'	D(S.)	"	"
1,1	,,3,5	JN	0,5,4	,3,4	B		.		1	"			"	"
1,2	,,3,7	FL	3,0,2	,6,2	D		.		2	1,7,8	(1'	D(S)	"	"
1,3	,,3,8	JN	0,4,0	,4,6	B		.		1	1,8,0			"	"
1,4	,,4,2	FL	3,5,7	,1,2	D		.	Q	1	(1,0"	(2")		"	"
1,5	,,4,9	JN	0,4,8	,5,6	B		.		1	1,8,0			"	"
1,6	,,5,2	JN	0,5,4	,6,0	B		.		1				"	"
1,7	,,5,4	FL	1,1,0	,7,8	D		.		2	1,7,7	(6'	D(S.)	"	"
1,8	,,6,0	FL	1,7,6	,7,8	D		.		1	1,7,0			"	"
1,9	,,2,0	JN	0,6,2	,7,6	A		.		1	"			"	"
2,0	,,8,1	JN	0,7,0	,7,0	B		.		1	"			C,G,M	"
2,1	,,8,3	FL	1,2,4	,7,8	D		.		2	"	(0,10	D(S)	"	"
2,2	,,8,5	JN	0,6,5	,8,8	B		.		1	"			Q,R,2	4
2,3	,,2,9	FL	0,6,0	,7,0	D		.		1	(NAIL)			"	"
2,4	,,9,8	FL	1,4,0	,4,0	D		.	G	3	1,7,8			"	"
2,5	,1,0,2	JN	1,5,1	,7,0	A		.		1	1,8,0			"	"
2,6	,1,0,4	JN	0,8,4	,8,0	B		.		1	"			C,G,M	"
2,7	,1,1,0	JN	0,5,4	,8,0	A		.		1	"			"	"

MAPPING SHEET

Card Type	Identification	Elevation	Dan.	Formatn.	Level	Location
0,1,0,1	8,7,0,1, XC			M,A,T		N,Q,M,

Local Grid		Traverse				Nos.	Reference
Northing	Easting	Trend	Plunge	Length	Sc.	Obs.	Direction
6,4,0,0	6,1,0,0,0	159	+0,0	4,0,0		5,0	

Remarks: 8701 – XCut, New Quinsee Mine

DISCONTINUITY DATA

0,2 Card Type												Identification 8,7,0,1, XC	
	Discontinuity				Size	Shape	Flng.	Water	Waves	Line		Lthlgy.	Hrdn.
No.	Distance	Type	Strike	Dip			1 2		1 L A	Type	Pitch		
2,6	1,1,4	FL	1,0,2	8,2	D			1	1,7,8	(4'	Dis.)	C,G,M	R,G
2,9	1,1,9	JN	0,5,2	2,0	B			1	1,8,0			Q,R,Z	H
3,0	1,2,4	"	1,5,0	9,0	B			1	"			"	"
"	1,3,5	FL	2,1,0	7,4	C			1	"			"	"
"	1,3,4	BG	2,2,0	3,6				1	"			"	"
"	1,4,5	JN	2,4,5	8,6	A			1	"			"	"
3,4	1,6,3	FL	2,2,5	8,2	D			1				C,G,M	"
3,5	2,0,5	FL	2,1,4	7,6	D			1	(N,A,M)			Q,R,Z	
3,6	2,1,8	JN	2,2,8	3,5	B			1	1,8,0			"	"
3,7	2,1,9	"	0,4,5	4,0	B			1	"			"	"
"	2,4,1	"	1,9,2	6,8	D		6 2	1	1,7,6			"	"
"	2,4,4	FL	1,6,2	7,1	D			1	1,8,0	(4'	Dis.)	G,G,M	"
4,0	2,5,6	"	9,1,2	7,4	D		6	1	"			"	"
4,1	2,5,6	"	1,0,2	6,2	D			1	"	(~1'	Dis.)	"	"
4,2	2,6,0	JN	1,6,2	5,0	B			1	"			Q,R,Z	"
4,3	2,6,7	"	2,8,0	9,0	A			1	"			"	"
4,4	2,7,5	"	0,9,4	8,2	C		R	1	(1")			"	"
4,5	2,8,0	"	3,3,2	7,2	B			1	1,8,0			"	"
4,6	2,8,5	"	0,7,2	7,7	C			1	"			"	"
4,7	2,9,1	"	0,5,2	5,0	C			1	"			C,G,M	"
4,8	2,9,7	FL	1,4,2	7,0	D			1	(N,A,M)			"	"
4,9	3,0,5	JN	2,3,0	5,2	A			1	1,8,0			"	"
5,0	3,1,2	FL	0,1,6	7,6	D			1	1,7	(~1'	Dis.)	Q,R,Z	"
5,1	3,1,2	JN	3,3,0	4,8	C			1	1,8,0			"	"
5,2	3,1,8	"	2,9,6	6,2				1	"			"	"
5,3	3,2,7	"	3,4,8	5,4	B			1	"			"	"
5,4	3,2,5	FL	1,3,6	7,1	D			1	"			"	"

MAPPING SHEET

Card Type	Identification	Elevation	Conn.	Formatn.	Level	Location
0,1,0,1	8,7,0,1,X,C			M,A,T		N,O,M,

Local Grid		Traverse				Nos.	Reference
Northing	Easting	Trend	Plunge	Length	Sc.	Obs.	Direction
6,9,0,0	6,1,0,0,4	1,5,0	+ -	4,0,0		7,4	

Remarks: 8701-XCUT ; New Quirke Mine

DISCONTINUITY DATA

*,0,2 Card Type													Identification 8,7,0,1,X,C	
	Discontinuity				Size	Shape	Clng.		Waver	Waves	Line		Lthlgy.	Hrdn.
No.	Distance	Type	~~Strike~~	Dip			1	2		I L A	Type	Pitch		
5,5	3,3,0	F,L	1,3,4	8,4	D				1	1,8,0	(2'	Dis.)	Q,R,Z	R,4
5,6	3,3,1	F,L	1,4,7	8,6	D			G	2	(1")				
5,7	3,3,8	F,L	3,3,6	8,4	D				1	1,8,0				
5,8	3,3,8	J,N	2,4,2	3,4	B				1					
5,9	3,4,0	J,N	1,4,5	6,0	A				1					
6,0	3,4,1	F,L	1,7,2	5,4	D			Q	1"	1,7,8	11.5'	Dis.)	C,G,N	
6,1	3,4,8	F,L	1,4,2	9,0	D				1	1,7,9				
6,2	3,5,0	J,N	1,1,2	7,5	B				1	1,8,0				
6,3	3,5,2	J,N	1,5,5	7,0	B				1					
6,4	3,5,6	J,N	2,1,0	6,2	B				1					
6,5	3,5,7	F,C	1,5,9	7,4	D			G	2	1,7,6	(2"			
6,6	3,6,4	F,L	1,3,2	7,6	D				1	1,8,0				
6,7	3,7,4	J,N	2,1,2	6,0	B				1					
6,8	3,7,7	F,L	1,9,5	7,0	D						(1'	Dis),		
6,9	3,8,0	F,L	1,8,6	8,0	D				1				Q,R,Z	
7,0	3,8,4	J,N	1,2,4	3,2	B				1					
7,1	3,8,5	J,N	1,5,4	6,5	B				1					
7,2	3,8,5	J,N	1,9,0	5,1	B				2					
7,3	3,9,6	J,N	1,3,8	8,0	B				1					
7,4	4,0,0	F,L	1,3,2	6,8	D				1				C,G,N	

MAPPING SHEET

TRAVERSE LINE

Card Type	Identification	Elevation	Dmn.	Formatn.	Pit Bench Level	Pit Bench Location
0,1,0,1	9,7,2,1,-XC			M,A,T		N,Q,M,

Local Grid Northing	Local Grid Easting	Traverse Trend	Traverse Plunge	Traverse Length	Sc.	Nos. Obs.	Reference Direction
6,1,6,0	6,1,2,1,0	35	1,0,	,4,1,7		2,7	

Remarks: 9721-X CUT, New Quirke Mine

DISCONTINUITY DATA

*,0,2 Card Type — Identification 9,7,2,1,-X,C

No.	Discontinuity Distance	Type	Strike	Dip	Size	Spac.	Flng. 1	Flng. 2	Water	Waves I	Waves L	Waves A	Line Type	Line Pitch	Lthlgy.	Hrdn.
0,1	,0,0	J,N	1,5,4	,6,2					1	1,8,6					Q,R,Z	R,4
0,2	,0,3		1,8,5	,6,5					1							
0,3	,0,6		2,4,0	,6,2					1							
0,4	,1,0		1,6,8	,8,6					1							
0,5	,1,9		0,9,2	,8,4					1							
0,6	,2,6		0,9,4	,7,0					1							
0,7	,3,1		3,4,4	,6,7					1						C,G,L	
0,8	,3,5		0,7,5	,2,4					2	1,7,7						
0,9	,3,6		1,6,8	,2,4					1	1,8,6						
1,0	,3,7		0,1,4	,8,8					1							
1,1	,4,0		0,6,7	,2,4					1							
1,2	,4,6		1,6,8	,8,2					1						Q,R,Z	
1,3	,4,9		1,6,2	,2,4					1							
1,4	,5,		1,6,3	,2,3					1							
1,5	,5,6		2,4,2	,7,8					1							
1,6	,6,4		3,5,4	,8,4					1							
1,7	,6,5		2,4,2	,8,2					1							
1,8	,6,8		0,6,2	,8,4					2							
1,9			2,7,3	,8,2					1							
2,0	,7,0		3,5,0	,6,2					1							
2,1			0,4,2	,7,6					1							
2,2	,7,4		2,7,4	,8,2					1						Q,R,F	
2,3	,7,5		3,2,0	,6,5					1							
2,4	,7,8		0,6,3	,8,2					1							
2,5			1,7,4	,2,					1							
2,6	,8,0		3,3,7	,6,5					2							
2,7	,8,2		3,4,7	,2,					1							

MAPPING SHEET

TRAVERSE LINE

Card Type	Identification	Elevation	Dan.	Formatn.	Pit Bench Level	Pit Bench Location
0,1,0,1	9,7,2,1,-X,C	, , ,	,	M.A.T.	, , ,	N.O.M.

Local Grid Northing	Local Grid Easting	Traverse Trend	Traverse Plunge	Traverse Length	Traverse Sc.	Nos. Obs.	Reference Direction
,6,1,6,0	,6,1,2,1,0	,3,5°	±,0,0	,4,1,7		5,4	, , ,

Remarks: 9721-X CUT, New Quirke Mine

DISCONTINUITY DATA

•,0,2 Card Type — Identification 9,7,2,1,-X,C

No.	Discontinuity Distance	Type	~~Strike~~	Dip	Size	Shape	Flng. 1	Flng. 2	Waviness	Waves I	Waves L	Waves A	Line Type	Line Pitch	Lthlgy.	Hrdn.
2,8	,8,5	B,G	2,0,3	,3,8			,		2	,	—	,	,	, , ,	Q,U,F	R,4
2,9	,8,6	J,N	2,0,4	,7,4	D	,			1	1,8,0	,	,	,	, , ,	~	~
3,0	, , ,	~	1,7,5	,8,2	A	,			1	~	,	,	,	, , ,	~	~
3,1	,8,9	~	2,7,4	,7,8	B	,			1	~	,	,	,	, , ,	~	~
3,2	,9,2	~	2,7,2	,8,1	A	,			1	~	,	,	,	, , ,	~	~
3,3	,9,4	,	2,6,5	,6,2	A	,			1	~	,	,	,	, , ,	~	~
3,4	,9,7	~	3,4,0	,5,0	A	,			1	~	,	,	,	, , ,	~	~
3,5	,10,1	~	3,5,5	,6,5	D	,			1	1,7,8	,	,	,	, , ,	~	~
3,6	,10,5	~	3,4,0	,5,0	A	,			1	1,8,0	,	,	,	, , ,	~	~
3,7	,11,6	B,G	2,1,0	,2,~		,			2	—	,	,	,	, , ,	~	~
3,8	,11,7	J,N	3,4,2	,5,0	B	,			2	1,8,0	,	,	,	, , ,	~	~
3,9	,11,9	,	3,4,3	,5,6	D	,			1	~	,	,	,	, , ,	~	~
4,0	,12,1	,	3,4,2	,7,5	D	,			1	~	,	,	,	, , ,	~	~
4,1	,12,4	,	3,4,2	,6,5	B	,			1	~	,	,	,	, , ,	~	~
4,2	,13,1	,	3,1,5	,7,0	A	,			1	~	,	,	,	, , ,	~	~
4,3	,13,2	,	2,7,0	,7,~	A	,			1	~	,	,	,	, , ,	~	~
4,4	,14,4	,	0,7,0	,8,1	E	,			1	~	,	,	,	, , ,	~	~
4,5	,16,8	,	0,4,8	,8,0	D	,			2	1,7,7	,	,	,	, , ,	~	~
4,6	,14,9	,	3,4,2	,8,1	A	,			1	1,8,0	,	,	,	, , ,	~	~
4,7	,15,4	,	0,2,5	,8,5	B	,			1	~	,	,	,	, , ,	~	~
4,8	,15,5	,	3,4,3	,8,5	E	,			1	~	,	,	,	, , ,	~	~
4,9	,15,7	,	0,3,8	,8,5	D	,			1	~	,	,	,	, , ,	~	~
5,0	,15,8	,	3,3,0	,9,0	E	,			1	~	,	,	,	, , ,	~	~
5,1	,16,0	,	0,4,2	,8,9	E	,			2	1,7,6	,	,	,	, , ,	~	~
5,2	,16,1	,	1,3,7	,~,~	C	,			1	1,8,0	,	,	,	, , ,	~	~
5,3	,16,3	,	1,7,5	,6,5	B	,			1	~	,	,	,	, , ,	~	~
5,4	,16,8	,	3,5,2	,7,8	D	,			1	~	,	,	,	, , ,	~	~

MAPPING SHEET

TRAVERSE LINE

Card Type	Identification	Elevation	Dan.	Formatn.	Pit Bench Level	Pit Bench Location
0,1,0,1	9,7,2,1,-,X,C	, , ,	,	M,A,T	, , ,	N,O,M,

Local Grid Northing	Local Grid Easting	Traverse Trend	Traverse Plunge	Traverse Length	Sc.	Nos. Obs.	Reference Direction
, 6,1,6,0	,6,1,2,1,0	,3,5	±,0,0	,4,1,7		8,1	, , ,

Remarks: 9721 – X CUT, New Orleans Mine

DISCONTINUITY DATA

•,0,2 Card Type — Identification 9,7,2,1,-,X,C

No.	Discontinuity Distance	Type	Strike	Dip	Size	Spac.	Flng. 1	Flng. 2	Water	Waves I L A	Line Type	Line Pitch	Lithlgy.	Hrdn.
5,5	,1,7,0	J,N	0,5,8	,8,4	B		,		1	,1,8,0	,	, ,	D,H,F	R,4
5,6	,1,7,2	,	9,5,0	,7,2	A		,		1	,,,	,	, ,	,,,	,,
5,7	,1,7,4	,	3,5,2	,2,4	F		,		1	,,,	,	, ,	,,,	,,
5,8	, , ,	,	9,5,2	,7,4	A		,		1	,,,	,	, ,	,,,	,,
5,9	,1,7,8	,	3,4,9	,7,9	B		,		2	,,,	,	, ,	,,,	,,
6,0	,1,8,1	,	3,3,4	,7,9	A		,		1	,,,	,	, ,	,,,	,,
6,1	,1,8,3	,	3,4,2	,7,6	B		,		1	,,,	,	, ,	,,,	,,
6,2	,1,8,8	,	2,3,7	,8,3	B		,		1	1,7,8	,	, ,	,,,	,,
6,3	,1,9,0	,	2,6,0	,7,0	A		,		1	1,8,0	,	, ,	,,,	,,
6,4	,1,9,3	,	3,4,0	,7,2	B		,		1	,,,	,	, ,	,,,	,,
6,5	,1,9,8	,	3,3,8	,8,8	A		,		1	,,,	,	, ,	,,,	,,
6,6	,2,0,1	,	3,3,7	,7,5	A		,		1	,,,	,	, ,	,,,	,,
6,7	,2,0,3	,	2,6,2	,8,9	A		,		1	,,,	,	, ,	,,,	,,
6,8	,2,0,4	,	0,0,7	,8,2	B		,		1	,,,	,	, ,	,,,	,,
6,9	,2,1,2	,	2,5,2	,6,2	B		,		2	1,7,7	,	, ,	,,,	,,
7,0	,2,1,5	,	3,5,2	,7,5	B		,		1	1,8,0	,	, ,	,,,	,,
7,1	,2,2,2	,	3,3,9	,7,6	B		,		1	,,,	,	, ,	,,,	,,
7,2	, , ,	,	2,6,8	,1,7	B		,		1	,,,	,	, ,	,,,	,,
7,3	,2,2,4	,	0,5,2	,8,5	B		,		2	,,,	,	, ,	,,,	,,
7,4	,2,2,5	,	3,2,7	,8,5	B		,		1	,,,	,	, ,	,,,	,,
7,5	,2,2,9	,	1,5,2	,8,7	B		,		1	,,,	,	, ,	,,,	,,
7,6	,2,3,2	,	3,1,0	,8,5	B		,		1	,,,	,	, ,	,,,	,,
7,7	,2,3,6	,	3,3,0	,8,0	A		,		1	,,,	,	, ,	,,,	,,
7,8	,2,4,4	,	0,8,8	,7,8	A		,		1	,,,	,	, ,	,,,	,,
7,9	,2,4,9	,	3,4,2	,8,6	B		,		1	,,,	,	, ,	,,,	,,
8,0	,2,5,0	,	1,4,0	,8,0	A		,		1	,,,	,	, ,	,,,	,,
8,1	,2,5,4	,	3,3,5	,7,9	B		,		1	,,,	,	, ,	,,,	,,

MAPPING SHEET

TRAVERSE LINE

Card Type	Identification	Elevation	Dan.	Formatn.	Pit Bench Level	Pit Bench Location
0,1,0,1	9,7,2,1,-,X,C	, , , ,	,	M,A,T.	, , ,	N,O,M,

Local Grid Northing	Local Grid Easting	Traverse Trend	Traverse Plunge	Traverse Length	Traverse Sc.	Nos. Obs.	Reference Direction
, ,6,1,6,0	,6,1,2,1,0	,3,5	±,0,0	,4,1,7		108	, , , ,

Remarks: 9721-X CUT, New Quirke Mine

DISCONTINUITY DATA

*,0,2 Card Type — Identification 9,7,2,1,-,X,C

No.	Discontinuity Distance	Type	Strike	Dip	Strength	Shape	Clng. 1	Clng. 2	Filling	Waves I L A	Line Type	Line Pitch	Lthlgy.	Hrdn.
8,2	,2,5,5	J,N	3,4,5	,7,4	B		,		1	1,8,0	,	, ,	Q,U,T	R,C
8,3	,2,5,7	F	3,4,8	,8,1	B		,		1	,~,	,	, ,	,~,	R
8,4	,2,6,0	F	3,3,5	,7,5	B		,		2	,~,	,	, ,	,~,	R
8,5	,2,6,6	F	3,3,6	,8,8	B		,		1	,~,	,	, ,	,~,	R
8,6	,2,7,2	F	3,3,7	,8,2	B		,		1	,~,	,	, ,	,~,	R
8,7	,2,7,3	F	3,2,0	,7,0	B		,		1	,~,	,	, ,	,~,	R
8,8	,2,7,8	F,C	3,4,0	,9,0	B		,	(N,C,)	2	,~,	,	, ,	,~,	R
8,9	,2,8,1	J,N	3,1,5	,8,8	B		,		1	,~,	,	, ,	,~,	R
9,0	,2,8,5	F	1,4,5	,7,9	B		,		1	,~,	,	, ,	,~,	R
9,1	, , ,	F	1,4,9	,8,9	B		,		1	,~,	,	, ,	,~,	R
9,2	,2,8,9	F	3,2,7	,8,2	B		,		2	,~,	,	, ,	,~,	R
9,3	,2,9,1	F	1,4,4	,8,6	B		,		1	,~,	,	, ,	,~,	R
9,4	,2,9,2	F	3,3,3	,8,1	B		,		1	,~,	,	, ,	,~,	R
9,5	,3,0,2	F	3,3,4	,8,6	B		,		1	,~,	,	, ,	,~,	R
9,6	,3,0,7	F	3,3,5	,8,7	B		,		1	,~,	,	, ,	,~,	R
9,7	,3,1,5	F	1,6,7	,8,4	B		,		1	,~,	,	, ,	C,G,M	R
9,8	,3,1,7	F	0,0,5	,8,5	B		,		1	,~,	,	, ,	,~,	R
9,9	,3,2,1	F	0,6,8	,8,4	B		,		1	,~,	,	, ,	,~,	R
10,0	, , ,	F	1,5,8	,8,9	B		,		1	,~,	,	, ,	,~,	R
0,1	,3,2,2	B,G	2,5,6	,3,0			,		1	,~,	,	, ,	,~,	R
0,2	,3,2,3	F,C	1,6,2	,2,2	D		,		2	,~,	,	, ,	,~,	R
0,3	,3,3,0	J,N	2,7,0	,7,2	B		,		1	,~,	,	, ,	,~,	R
0,4	,3,4,0	B,G	2,1,0	,3,8			,		1	,~,	,	, ,	,~,	R
0,5	, , ,	J,N	2,7,5	,6,0	B		,		1	,~,	,	, ,	,~,	R
0,6	, , ,	F	1,8,9	,2,6	B		,		1	,~,	,	, ,	,~,	R
0,7	,3,4,3	F	3,2,5	,8,7	B		,		1	,~,	,	, ,	,~,	R
0,8	, , ,	F	0,7,2	,5,8	B		,		1	,~,	,	, ,	,~,	R

MAPPING SHEET

TRAVERSE LINE

Card Type	Identification	Elevation	Dmn.	Formatn.	Pit Bench Level	Pit Bench Location
0,1,0,1	9,7 2,1,-xC	, , , ,	,	M,A,T.	, , ,	N,Q,M,

Local Grid Northing	Local Grid Easting	Traverse Trend	Traverse Plunge	Traverse Length	Traverse Sc.	Nos. Obs.	Reference Direction
, ,6,1,6,0	,6,1,2,1,0	,3,5	±,0,0	,4,1,7		135	, , , ,

Remarks: 9721 - xCut 1 Nov Quince Mine

DISCONTINUITY DATA

*,0,2 Card Type Identification 9,7 2,1,- xC

No.	Discontinuity Distance	Type	Strike	Dip	Line	Spac.	Flag. 1	Flag. 2	Waves	Line Type	Line Pitch	Lthlgy.	Hrdn.
									I L A				
0,9	,3,4,5	J,N	1,4,5	,7,9	B		,	1	1,2,0	,	, ,	C,G,M	R,4
1,0	,3,5,2	"	1,4,3	,7,5	C		,	1	, ,	,	, ,	"	"
1,1	,3,5,5	"	1,4,5	,2,9	B		,	2	, "	,	, ,	D,R,Z	"
1,2	,3,5,6	"	9,7,2	,7,8	B		,	1	, "	,	, ,	"	"
1,3	,3,5,7	"	2,4,2	,2,4	A		,	1	, "	,	, ,	"	"
1,4	,3,5,8	"	2,4,5	,8,4	A		,	1	, "	,	, ,	"	"
1,5	,3,6,1	"	3,2,2	,6,1	C		,	1	, "	,	, ,	"	"
1,6	,3,6,3	"	1,2,2	,7,6	A		,	1	, "	,	, ,	"	"
1,7	,3,6,4	R,C	2,1,0	,3,5			,	2	1,7,4	,	, ,	"	"
1,8	,3,6,7	J,N	1,2,8	,6,4	A		,	1	1,8,0	,	, ,	"	"
1,9	, , , ,	"	2,6,2	,6,0	A		,	1	, "	,	, ,	"	"
2,0	,3,7,0	"	2,6,0	,7,0	B		,	1	, "	,	, ,	"	"
2,1	,3,7,1	"	1,5,2	,8,2	B		,	1	, "	,	, ,	"	"
2,2	,3,7,2	"	9,8,2	,7,2	B		,	2	, "	,	, ,	"	"
2,3	,3,7,3	"	1,6,5	,7,2	B		,	2	1,7,7	,	, ,	"	"
2,4	, , , ,	"	2,2,6	,7,5	B		,	1	1,8,0	,	, ,	"	"
2,5	,3,8,4	"	0,4,1	,8,5	B		,	1	, "	,	, ,	"	"
2,6	, , , ,	"	9,2,6	,7,4	B		,	1	, "	,	, ,	"	"
2,7	,3,8,1	"	2,2,2	,8,5	B		,	1	, "	,	, ,	"	"
2,8	, , , ,	"	2,0,5	,8,0	A		,	2	, "	,	, ,	"	"
2,9	, , , ,	"	1,4,2	,8,0	A		,	1	, "	,	, ,	"	"
3,0	,3,8,6	"	, , ,	, , ,	B		,	2	, "	,	, ,	"	"
3,1	,3,8,7	"	1,1,5	,7,2	B		,	1	, "	,	, ,	"	"
3,2	,3,8,9	"	2,6,2	, , ,	A		,	1	, "	,	, ,	"	"
3,3	,3,9,0	"	2,9,0	, , ,	A		,	2	, "	,	, ,	"	"
3,4	,3,9,1	"	1,6,0	, , ,	A		,	1	, "	,	, ,	"	"
3,5	,3,9,2	"	2,6,0	, , ,	A		,	1	, "	,	, ,	"	"

MAPPING SHEET

TRAVERSE LINE

Card Type	Identification	Elevation	Dan.	Formatn.	Pit Bench Level	Pit Bench Location
0,1,0,1	9,7,2,1,-,XC	, , , ,	,	M,A,T.	, , ,	N,O,M,

Local Grid Northing	Local Grid Easting	Traverse Trend	Traverse Plunge	Traverse Length	Sc.	Nos. Obs.	Reference Direction
,6,1,6,0	,6,1,2,1,0	,3,5	±,0,0	,4,1,7		149	, , ,

Remarks: 9721 – X CUT, New Quirke Mine

DISCONTINUITY DATA

°,0,2 Card Type — Identification 9,7,2,1,-,X,C

No.	Discontinuity Distance	Type	Strike	Dip	Shape	Stepp.	Flng. 1	Flng. 2	Water	Waves I	Waves L	Waves A	Line Type	Line Pitch	Lthlgy.	Hrdn.
3,6	,3,9,5	J,N	0,1,0	,8,0	R		,		1	1,8,0	,	,	,	,	0,R,Z	R,4
3,7	,3,9,7	"	0,2,5	,8,4	C		,		1	"	,	,	,	,	, "	"
3,8	, , ,	"	3,2,2	,8,5	R		,		1	"	,	,	,	,	, "	"
3,9	,4,0,0	C	1,2,0	,7,2	R		,		2	1,7,8	,	,	,	,	, "	"
4,0	,4,0,1	I	0,0,4	,8,5	P		,		1	1,8,0	,	,	,	,	, "	"
4,1	,4,0,2	"	1,9,2	,8,5	R		,		1	"	,	,	,	,	C,G,M	"
4,2	,4,0,3	"	3,2,5	,7,5	R		,		2	"	,	,	,	,	, "	"
4,3	, , ,	F,L	1,8,2	,4,1	C		Y,RM		2	"	,	,	,	,	, "	"
4,4	,4,0,2	B,K	2,1,5	,3,2			,		1	"	,	,	,	,	, "	"
4,5	,4,0,8	J,N	0,2,5	,8,5	R		,		1	"	,	,	,	,	, "	"
4,6	,4,1,2	"	0,3,4	,7,5	A		,		1	"	,	,	,	,	, "	"
4,7	,4,1,3	"	0,3,5	,8,4	R		,		1	"	,	,	,	,	, "	"
4,8	,4,1,5	"	0,2,4	,7,0	C		,		1	"	,	,	,	,	, "	"
4,9	,4,1,7	"	3,3,2	,8,2	C		,		1	"	,	,	,	,	, "	"
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